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Electrical Development.

FOR several reasons more than usual interest attaches to the report of the past year's activities of the Council of the British Electrical Development Association. It has been a change-over period and we think the industry will wish to congratulate Lieut.-Col. W. A. Vignoles, the Director and Secretary, and his staff, upon the fact that steady progress has been made, and that greater support has been received from all sections of the industry than ever before. Reorganisation of the Provincial Area Sub-Committees has been proceeding and this has promoted new interest in both the supply and manufacturing departments and secured additional membership and financial support. When the new organisation is thoroughly established still greater progress of this kind is expected.

Good work has been done by the Industrial Electric Heating Sub-Committee, both in the carrying out of investigations and the writing of papers and reports, and in the organisation in conjunction with local electricity authorities of most interesting and effective exhibitions. From our abstract of the Council's report appearing on another page it will be seen that manufacturers of electric refrigerators were generally satisfied with the results of their particular sectional campaign, and that the National Window Display proved to be excellent propaganda, 704 displays being exhibited in different parts of the kingdom. There has been a good deal of exhibition activity included in the year's operations, not merely the holding of exhibitions, but preparatory and deliberative work for such events as the Newcastle-on-Tyne exhibition, of which we gave particulars in our last issue, and the proposed Faraday Celebrations to be held in 1931. It is a matter for regret that Electric Vehicle Committee proceedings seem still to be on so small a scale; this is a section where one has often longed for more "push and go." Even now we will not give up hope. The Factory and Workshop Lighting Campaign was a very specialized affair and the

Council reports that it caused considerable interest in all parts of the country and brought about direct results and definite business. Next autumn there will be a more or less expert follow-up effort among specially prepared lists of factory owners. It is well that everybody should know that the Association has a large collection of lantern slides and special electrical kinematograph films for use by those engaging in electrical propaganda work; and a very satisfactory feature of the finances is found in the transfer to Reserve of £5,000 from the surplus at December, 1928. We have no doubt that there will be ample need for special funds in the year 1931, if not before.

One of the most important matters touched upon in the report is the very useful work that is being done by electrical women in arousing electrical interest in the minds of women in general throughout the country.

The annual dinner of the Association took place on Thursday evening last week, with Sir John M. Gatti, the president, in the chair, and the Earl of Birkenhead, who has lately become identified with the electricity supply industry, as guest. The Earl had something to say regarding the problem of encouraging foreign capital into British electrical enterprise, but he was on ground which everybody will consider appropriate to the work of the Association when he referred to the enormous scope that there is for developing the domestic load. It is emphatically in accord with our oft-reiterated policy that no limit can be placed to the early progress in this connection with excellent benefit both to the people of the United Kingdom and to the electrical industry. An interesting feature of the evening was the speech of Mr. J. W. Beauchamp, for not once during his period of the directorship was his voice heard at the annual functions. This time he toasted the guests, Sir Herbert Morgan replying.

The annual general meeting of the Association followed on Friday afternoon, when Dr. S. Z. de Ferranti was elected president in succession to Sir John Gatti. We are convinced that no more popular election could have been made. The Association stands for the popularisation of electricity supply and for many years Dr. Ferranti has been an outstanding leader of thought in that movement. We have every reason to look forward to a year of unhesitating advance and record success.

Imperial Chemical House.

The building and equipping of Imperial Chemical House, Millbank, London, the new headquarters of Imperial Chemical Industries, Ltd., the electrical equipment of which we describe in following pages, seem to have been governed by one consideration only—everything must be the best. Because of that the extent to which electricity has been employed is particularly interesting and encouraging. There is not an important service in the building in which electrical energy does not play an essential part—lighting, heating, cooking, lifts, pumps, telephones, bells, and so on.

It is not often that so many specialised electrical schemes are embodied in one installation, at any rate in this country, and there is something new to see for almost any electrical engineer, no matter in what branch of the industry he is particularly interested.

The outstanding feature of the electrical work is no doubt the lighting system. In view of the attention that is being given nowadays to obtaining effect by means of elaborate exposed fittings, the installation at Imperial Chemical House, which embraces some 3,000 points all arranged on the concealed principle, and of which some examples of the effects are indicated by means of reproductions of special night photographs, is especially commendable.

A very interesting point is that the schemes were drawn up by engineers who apparently have no personal bias in favour of electrical methods, and we congratulate Sir Frank Baines, K.C.V.O., the architect, and his staff, as well as the manufacturers and others employed on the installation, on the results obtained.

The G.E.C. Share Policy.

In proposing to make a large issue of ordinary shares to the general public, restricting them to British subjects, the General Electric Co., Ltd., was adopting an original course and one which Sir Hugo Hirst, Bart., the chairman, says will have to be adopted by other concerns in the interests of British national industry. The company has been emphatic in announcing its intentions to preserve its British national character, and the fact that it has been deprived by recent American buying of its shares of 60 per cent. of its shareholders has made necessary action more drastic than that taken last September in altering the Articles. Many of the shareholders have been and still are the company's customers, and the directors were taking the above action partly with a view to ensuring a continuance of that state of affairs.

The September resolutions providing for the retention of the control in British hands did not prevent considerably more than half of the ordinary shares going to the United States. It will easily be understood that a British board would find its position almost untenable if an overwhelming majority of the shares remained in American hands. Therefore to balance the American holdings, while redeeming the company's debentures, the directors are creating this new block of British ordinary shares.

It will be interesting to review briefly the market price movements in the shares. A year ago G.E.C. ordinary shares stood at 35s. They gently appreciated and in November and December were steady at 42s. In the middle of the latter month there was a slightly greater rise, which was maintained until January, when there was a sudden jump to 60s. Eventually they went to about 80s. and dropped to about 65 but still remained high until the directors' recent announcement was made, when they shed 10s. There is little doubt that American buying and purely speculative operations were responsible for the inflated prices reached for securities whose reasonable quotation based on the yield for an industrial security of the class could not be more than the price of the new issue—42s. During the early days of this week the shares were at one time dealt in at 70s., so that it can be seen that, from the "market" point of view, if the new shares were offered to the existing shareholders at 42s. the margin would provide a very substantial "bonus." The most casual students of G.E.C. finances have known for years past that Sir Hugo and his colleagues have regarded the 7 per cent. debenture stock as a blot on their balance sheet. It was issued, however, at a time when there was no alternative. The issue of 1,500,000 shares at £2 2s., that was contemplated, but is now announced as postponed, will bring in an accession of British ordinary shareholders and customers—a useful set-off against the recent American purchases; and it will enable the heavy interest debentures to be redeemed, reducing substantially the heavy charges which stand in front of the preference and ordinary securities. Thus will there be a better prospect for the ordinary shareholder in respect of interest and bonus, and the directors will preserve the British holding and the old traditions.

The postponement of the issue is due to a request cabled by the American Committee asking the G.E.C. board to consider negotiations on some different financial basis which would continue effective management without depriving American stockholders of proprietary ownership. To this cable Sir Hugo Hirst replied welcoming some such consultation so long as the board attained the objects it had in view; indeed he mentioned that the G.E.C.'s own financial advisers had already elaborated a plan "which in our opinion safeguards both objects."

New London Tramcars.

A brief description of a new luxury type of electric tramway car that has been designed for service on the Metropolitan Company's system.

AN entirely new type of tramcar has been built for Tramway Companies connected with the Underground Railway group, which has for some years been giving close attention to the design of new

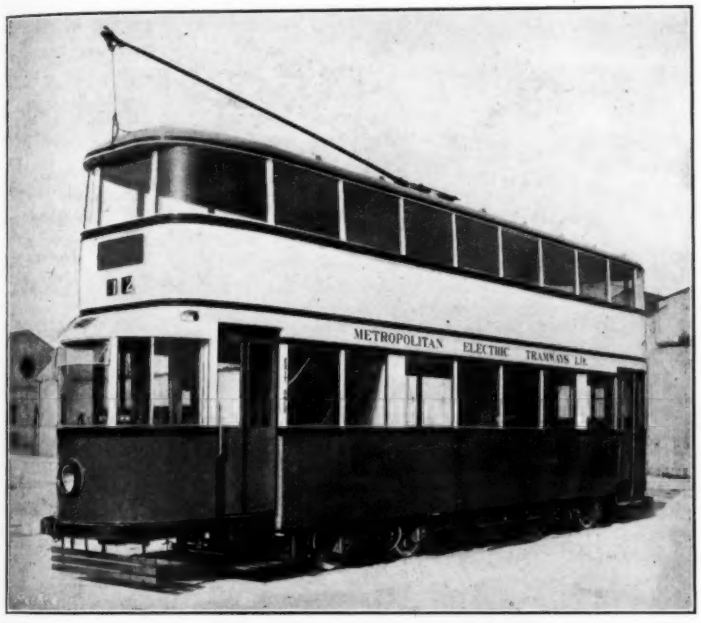


Fig. 1.—An Experimental M.E.T. Car.

tramway cars, and two years ago put into service two cars built on somewhat novel lines.* As a result of experience and the valuable criticisms of passengers, an entirely new type of tramcar has been evolved and an experimental car of this latest design is now finished, fig. 1, and ready, when licensed, to be put into service on the Metropolitan Electric Tramway Company's lines. It has been designed and constructed by the Union Construction Company (the builders of the latest type of tube railway car) working in collaboration with the tramway staff. The intention of the designers is to provide the public of London with a large-capacity vehicle, running swiftly and silently, giving the maximum of comfort, and capable of dealing with mass traffic.

An advantage of the new car which is immediately apparent is the separate entrance and exit doors, fig 2, while on boarding the car the impression is at once obtained of comfort, light, and general airiness. Large platform accommodation adds to the sense of roominess and the seats are of the cross type and upholstered in moquette.

The decoration is attractive and the centre of gravity is low, which makes for steadiness and stability when running at high speed. The driving equipment consists of four Metro-Vick motors of 35 h.p. each, which give quick acceleration. The comfort of the driver and conductor has not been overlooked. The driving cabin is so arranged that the driver, like the 'bus driver, may, if he wishes, be seated, having at his command electrically-operated 8-wheel brakes, which can bring the car to a stand-still in a very short distance in case of need, and yet act with smoothness for ordinary stops.

* Electrical Review, March 11th, 1927.

Some thirty-five 40-W lamps illuminate the saloons and platforms; they are semi-concealed in the ceilings. special dipping headlights can be operated by the driver in foggy weather to project a beam on to the track. The lamps over the exit steps are switched on automatically as the doors open. The interior has a cheerful apearance: on the lower deck are seven wide windows each side and on the upper deck 10 aside. In each case the window supports are thin, so that the passengers' view is practically unobstructed. The predominating colour of the interior is grey, all panels being of silver-grey wood.

There will be no lack of ventilation, for in the lower saloon simple apparatus enables four of the windows on each side to be raised and lowered by passengers, as desired; on the upper deck, there are 10 windows of the same type. Each platform, too, has a pair of "drop" windows and all the windows are of a maximum clear opening of 1 foot when fully open. The interiors of both saloons have been designed as free as possible from all mouldings, or corners, which would be liable to form dust traps The floors are covered with cork carpet. The upper saloon, contrary to the present practice, is equally luxurious as the lower saloon. The companies have for some time been pursuing a policy of reconditioning and remodelling their

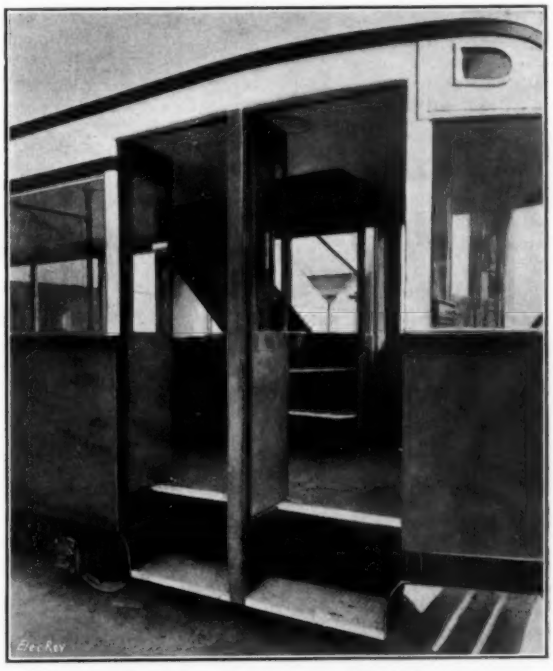


Fig. 2.—Entrance and Exit Doors.

rolling stock, and the result was reflected in the traffic in 1928, for the passengers carried amounted to 192,867,000, against 180,800,000 in 1927, an increase of 7 per cent.

Imperial Chemical House.

Electricity is used extensively at the new headquarters of Imperial Chemical Industries, Ltd., for lighting, cooking and other services.

THE fullest possible use is made of electricity in Imperial Chemical House, situate at Millbank, London, the new head offices of Imperial Chemical Industries, Ltd., and there are many novel and interesting features in connection with the electrical equipment installed. The architect, Sir Frank Baines, K.C.V.O., has given considerable attention to the engineering services, realising that they play a vital part in the working of a large commercial building. Some idea of the extent of the electrical installation may be gathered from the fact that about 75 miles of electric cable and wire have been used on the job, and about 25 miles of conduit serves over 3,000 lighting points. The cable was supplied by Messrs. W. T. Glover & Co., Ltd., and the conduit and fittings by the Walsall Hardware Manufacturing Co. The electricity is taken from the mains of the Westminster Electric Supply Corporation at 3-phase, 400 V, 50 cycles. Practically all the motors in the building are supplied at 3-phase, and the lighting and cooking at single-phase, 230 V. The total connected load for the whole installation is about 1,600 kilowatts.

Fig. 1.—Imperial Chemical House.

Messrs. Richard Crittall & Co., Ltd., were entrusted, *inter alia*, with the installation of the equipment for warming and cooling the building. The installation is on the water-circulating panel system, the majority of the panels being cast in the soffits of the concrete floors to form ceiling heaters; supplementary panels are embodied in the external walls under windows in the corridors, and some of the parts exposed to frequent air changes, such as entrance halls, have floor panels. For the heating and hot-water supply there are three boilers, supplied by Messrs. H. & T. Danks (Netherton), Ltd., specially designed for burning anthracite, while a large refrigerator installed in the basement is used for the cooling-water supply. This equipment includes a triple-cylinder totally-enclosed ammonia compressor of Messrs. J. & E. Hall's latest design, directly coupled to a 140-h.p. Crompton Parkinson slip-ring induction motor, fig. 2, equipped with short-circuiting and brush-lifting apparatus, and control gear of the totally-enclosed oil-immersed type. Arrangements are made whereby the supply of power to the mtor is automatically cut off when certain predetermined temperature limits are reached. The compressor and motor are mounted together on a special foundation fitted with shock absorbers to deaden all noise and vibration. The water circulation is accelerated by directly-coupled electrically-driven centrifugal pumps, fig. 5; these, as well as the cold-water supply pumps, were manufactured by Messrs. Mather & Platt, Ltd. In the heating season water is circulated through the system at a temperature of about 110 deg. F., while in the summer, when necessary, cooled water at any required temperature down to 40 deg. F. can be circulated through the coils.

The water supply for the building is obtained from two artesian wells from which water is raised by means of compressed air. Two compressors installed for this purpose are each driven by a 28-h.p. motor, fig. 3; the maximum pressure employed at starting is 135 lb. per sq. in. There is a main storage tank in the basement and water is pumped to four steel storage tanks (capacity 10,000 gallons) in the roof by duplicate surface pumps operated automatically by float switchgear. The pumps are driven by 15-h.p. motors, fig. 5. In connection with the ventilation of the building, which was also carried out by Messrs. Crittall & Co., there are employed 23 extraction fans and 4 inlet fans driven by "Bull" motors.

There are some interesting features in connection with the lift installation in the building, supplied by Messrs. Waygood-Otis, Ltd., particularly as the lifts operate from a 3-phase a.c. supply. In the main entrance hall are four large lifts for general passenger service, the area of each car floor being approximately 25 sq. ft. The winding engines, fig. 4, which are fitted with high-speed internal-resistance motors of Messrs. Waygood-Otis's own design, are capable of raising a load of 2,000 lb. at a speed of 350 ft. per min., serving through a travel of 116 ft. The lifts are of the Waygood-Otis patent auxiliary micro-drive type, and are so designed that accurate stopping of the cars at the floor levels is assured, irrespective of the load or speed. The landing entrances are protected by specially-constructed two-speed self-closing doors, which work with ease and quietness. An interesting feature of the lifts is the illuminated call indicator which has been fitted to each car to warn the attendant when anyone is waiting on the landing for a lift; in place of the usual type of indicator, a soft-tone buzzer is employed, and instead of the usual flag indications used with an ordinary indicator, an illuminated figure appears, guiding the attendant to the right floor. On each of the landings an electric position indicator is fixed, and so arranged that the waiting passengers are able to see at a glance the position of each lift. There are four further lifts of the same type in different parts of the building for passenger service, and in addition there is a special lift devoted to the use of the directors; this lift is operated on the fully-automatic push-button system, and is capable of raising a load of 2,000 lb. at a speed of 350 ft. per min. It is claimed

to be one of the fastest push-button lifts installed in this country, and is provided with two-speed self-closing doors. An illuminated call indicator is provided similar to those which serve the passenger lifts in the main hall. There are also two electric goods lifts, each capable of raising a load of 2,240 lb. at a speed of 200 ft. per min., travelling through a distance of 116 ft.

Not the least interesting of the equipment in the building is the plant installed in the basement for handling the sewage, drainage and rainwater. The foundations and the bottom floors of Imperial Chemical House are carried down to such a depth that they are below the level of the public sewer, and provision had therefore to be made for lifting all drainage up to the sewer level. After careful consideration of the various methods available for doing this work, it was decided to install two vertical-spindle pumps coupled to suitable induction motors through short lengths of vertical shafting. All sorts of fibrous and solid matter have to be handled. The pumps employed are of the "Stereophagus" type, manufactured by the Pulsometer Engineering Co., Ltd. They are arranged with vertical spindles, so that while the pumps themselves are below the level of the sewage at starting, the motors are carried at a higher level to protect them from any damage due to flood, and at the same time to reduce the amount of floor space occupied. Each pump handles 170 gallons of sewage per minute, discharging it against a total head of 30 ft. The motors are of the protected slip-ring type manufactured by Messrs. Crompton Parkinson, Ltd., and are automatically controlled by a double-unit panel operating from floats in the suction sump. The floats are so set that as the sewage rises in the sump, the pumps are tripped in successively. Normally the capacity of each pump is sufficient to handle the flow of sewage, and then one pump only comes into operation. It continues running until the sump is nearly empty, and then automatically shuts down. If, however, due to storm, the flow of sewage exceeds the capacity of one pump, then the second pump is brought into operation to cope with the abnormal demand. Provision is made on the starter to cross-connect the pumps and floats, so that each pump may in turn cope with the normal flow and thus divide the work between the two sets. Fig. 6 shows one of the motors and the control equipment.

There is an interesting vacuum-cleaning plant, fig. 7, installed in the building by British Vacuum Cleaner and Engineering Co., Ltd. This consists of two exhausters of the multi-stage turbine type, directly coupled to 25-h.p. Crompton Parkinson squirrel-cage motors, 2,900 r.p.m. Ellison oil-cooled motor-starters are provided, and the starting current is kept within 2½ times full-load current, which for the two exhausters is approximately 60 A at 400 V, with thirty operators at work, resulting in a current consumption of approximately 800 W per operator. Each exhauster has an air displacement of 1,200 cu. ft. per minute at 6 in. mercury vacuum, and is connected to a multiple-bag filter which separates the dust from the conveying air before the air enters the exhauster. A horizontal suction ring-main pipe is erected in the basement of the building and connected by two branches into a single cross pipe between the two filters. The ring-main gives off 21 risers or headers passing up through the floors of the building. Each header has a hose-connecting point at each of the nine floors, making in all approximately 190 hose-connecting points throughout the building.

The private automatic telephone exchange which has been installed by the Reliance Telephone Co., Ltd., at Imperial Chemical House, consisting of a 2,000-line automatic switchboard, equipped at present for 1,000 lines, will be, it is claimed, when extended to its ultimate capacity, the largest and most up-to-date private telephone installation in the world. The equipment was manufactured by the General Electric Co., Ltd., and employs the same switches and general design of circuit arrangements as those standardised by the British Post Office for use in public exchanges. The system is auxiliary to the Post Office installation in the building, and its adoption has relieved the operators of the work of dealing with internal calls, which exceed 50 per cent. of the total telephone traffic.

The system operates on the machine-switching fully automatic principle, employing rotary pre-selectors with 25- by 3-point banks, double co-ordinate group selectors of the Strowger type with 330-point banks, and double co-ordinate final selectors with 100-line banks. The equipment is designed to operate on a mixed 3- and 4-digit dialling system, requiring first, second and third selectors. This arrangement has been introduced in order to reduce to a minimum the time taken in dialling. A pre-selector is provided for each line and they are mounted on racks in groups of 100, together with the final selectors.

Two sets of batteries, each consisting of 25 cells having an initial capacity of 293 Ah, form part of the equipment, and there are two motor-generator charging sets, fig. 9, which operate from the 400-volt, 3-phase, 50-cycle supply, each generator having an output of 82 amperes at 57 volts. A power switchboard, fig. 9, which controls the main supply to the motors, the battery charge and discharge, and the ringing and tone circuits, is equipped with two ringing machines, one a motor-generator set arranged to run from the supply, and the other a dynamotor operated from the exchange battery. A main distribution frame is provided for cross-connecting and the termination of the multiple dry-core cables. Visual and audible alarms are given of blown fuses and failures of the ringing circuit. Similar signals are given after an average delay of 1½ minutes if a receiver is left off or the called party fails to clear, while other signals are given after an average delay of half a minute if a release magnet should stick. Circuit-breaker and voltage-drop alarms are also provided. The retarded alarms are operated by means of a time switch which receives an impulse every three seconds from the low-speed interrupter cam and spring assembly on the ringing machines.

Dialling tone, busy tone and ringing tone are incorporated with the switching equipment, and a specially-designed testing set is fitted in a position adjacent to the main frame which, in addition to being designed to make all the usual tests, is fitted with a device for enabling the speed to be ascertained of any dial switch on the system. Fig. 8 is a view of the selector equipment. In connection with the telephone service in the building there are a night watchman's tell-table clock system and a number of emergency services. The watchman's service embodies a number of "contact boxes" on each floor, at each of which there is fitted a central-battery telephone communicating with a specially-designed 50-line switchboard.

Electricity is used extensively in the kitchens for cooking. In the main kitchen, which is designed to deal with 2,000 luncheons per day, the total connected load is 250 kW, which includes all the electric cooking apparatus, service equipment and preparing machines. The equipment was specially designed for the job by Messrs. Richard Crittall & Co., Ltd., and it includes two roasting ovens, fig. 10, with internal dimensions of 24 in. wide, 28 in. deep, and 52 in. high. The ovens are lined internally with white porcelain-enamelled iron sheets and element guards, lagged with non-conducting material; the fronts are of cast-iron and each oven is provided with double side-hinged insulated steel doors faced with "Silveroid." The shelf supports are easily removable to allow access to the elements and back of the ovens. Each compartment is loaded at 15 kW (maximum) and the elements are controlled by 3-heat switches, 'ZED' fuses being arranged in each circuit.

An electrically-heated pastry oven, fig. 11, has two compartments, each 38 in. wide by 32 in. deep by 11½ in. high, inside. The body is constructed of cast-iron and sheet steel, and is double cased and lagged. The heating element in each compartment is loaded at 6 kW (maximum). The electric cooking apparatus also includes a fish-frying suite 6 ft. long by 2 ft. 3 in. wide by 6 ft. 6 in. high, overall. It has three welded-steel pans, each 18 in. by 18 in. by 6 in. deep inside, and a

sheet-steel canopy enamelled inside and outside. Heating elements under each pan have approximate loadings of 7.5 kW each. A double-compartment electric grill is loaded at 10 kW per compartment.

There is also a suite of electrically-heated hot closets for the main service. The suite is approximately 36 ft. long by 3 ft. wide by 3 ft. high, and is constructed of cast-iron, with one continuous top plate made to fit round pillars of the building, and doors provided on the kitchen side. Two welded-steel Bain Maries form part of the hot closets. The heating elements in each of the end hot closets at the bottom are loaded at 6 kW, in the centre closet at 5 kW, and under each of the Bain Maries there are elements loaded at 4 kW. The remainder of the top plate of each of the end hot closets is equipped with elements loaded at 2.5 kW, while under the top plate of the centre portion elements loaded at 3 kW are provided. A private kitchen is equipped with an electrically-heated hot closet, with a maximum loading of 5.5 kW, and an electrically-heated grill, 10 kW.

In the service corridors, fig. 12, there are seven combined carving tables, Bain Maries and hot presses 8 ft. 8 in. long by 1 ft. 10½ in. wide. by 3 ft. high. These are heated electrically and thermostatically controlled. As part of the kitchen equipment there are three refrigerators supplied by Messrs. J. & E. Hall, Ltd. One of these is used for making and conserving ice cream. This comprises a compression machine directly coupled to a 3-h.p. Crompton Parkinson slip-ring induction motor. Two small "Hallmark" methylchloride compression plants are used to cool two insulated cold-storage chambers. These two machines are entirely automatic in operation, by means of electric thermostatic controls operated through mercury switches. One of these plants is driven by a 1-h.p. motor and the other by a ½-h.p. motor.

The artificial lighting of the building is, it is claimed, unique in two particulars: firstly, no pendant fittings are used in any part of the building above the basement, all the lamps being concealed in specially-formed recesses in the ceilings or walls, with their apertures closed by screens of diffusing glass; secondly, "artificial daylight" is used throughout. The pyramidical recesses in which the lamps are housed were formed during the construction of the floors above, each measuring 10 in. sq. by 7½ in. deep, with chamfered corners. The metal frames of the lighting units were pressed from sheet-aluminium by Messrs. Hailwood & Ackroyd, Ltd., and the diffusing-glass panels, which are each etched in a key pattern, were made by the London Sand Blast and Decorative Co. Fig. 17 is representative of the standard lighting in the ordinary rooms.

Thin sheet-steel liners, painted matt white and inserted in the recesses, act as reflectors. In the corridors the same type of lighting is used as in the offices, but the panels are larger and rectangular in shape and are spaced at 18-ft. centres. A specially designed reflector is housed above the glass panel, in the false ceiling of the corridor. The result is very successful, and the effect in the long corridors, fig. 15, with their perspective of glowing ceiling panels is particularly fine. The lighting point in the middle of each section of corridor is arranged as a pilot light, and is controlled by two-way switches at either end. In the conference rooms and rooms occupied by higher officials generally, octagonal ceiling fittings with a projection of about 7 in. are used.

Several methods of filtering were tried experimentally, and pale blue "Osram" lamps used behind uncoloured glass screens were finally adopted. Regarding the illumination provided, a scale of four foot-candles at the working plane was decided upon, and this is obtained with one 150-W gasfilled lamp in each standard unit. This gives a utilisation of about 25 per cent., or some 50 per cent. of that which would be obtained with "uncorrected" gasfilled lamps used in conjunction with direct reflectors.

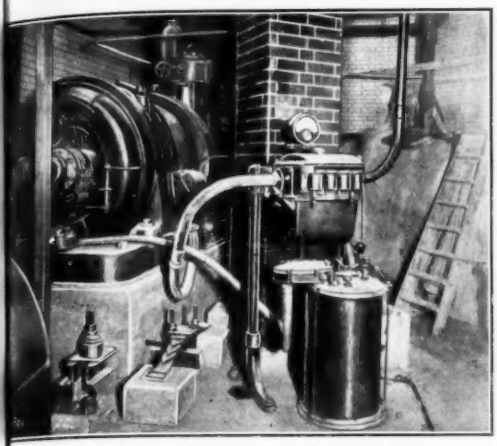
A very pleasing "sunlight" effect obtains in the main entrance halls and on the staircases, where the lighting is carried out by means of artificial windows. These consist of large recesses in the walls, closed by means diffusing glass which is bevelled in panes, the effect being heightened by applied strips of blue glass. The lamps are used indirectly and are carried in Metropolitan-Vickers reflectors at the top of each recess. The light is reflected and diffused evenly over the glass by means of specially designed backings, carried out in ply-wood and painted matt white. On the main landing of the directorate floor, fig. 18, artificial windows are provided at one end only of the staircase hall, and the lighting there is supplemented by means of lamps used indirectly in Grecian urns placed on ornate pedestals.

The lighting of the palatial directors' suite, which extends along the whole of the 6th floor main fronts, is unique. In the richly panelled and decorated principal rooms, no lighting devices are visible by day, but at the touch of a push button, a centre panel in each ornamental ceiling rises, and at the same time a corona of powefrul lamps above the ceiling glows into radiance until the room is brilliantly lighted by reflection from the raised panel. The effect is novel and striking. In addition to the raised panel, lighting reflectors are concealed in the cornices, the object being to relieve the shadows which would otherwise be cast by the heavy mouldings of the ceiling, and also to assist the general illumination. These cornice lights are switched on simultaneously with the centre light. The pressing of the switch a second time extinguishes the centre light, and the panel gently descends, leaving the room illuminated by the cornice lights only to about half the former intensity. A third touch of the switch extinguishes the cornice lights. The operating push button is in an 8-V circuit with relay switches which light the lamps and operate the solenoid which raises the panels. The solenoid and its accessories comprise what is, in effect, a miniature electric lift, including many features of modern lift construction. When the panel is raised to the full extent a cooling coil is switched in parallel with the main lifting solenoid, thus minimising the heating. The ceiling of the magnificent walnut-panelled board room is exceptionally fine, and carries two of these novel lighting units; fig. 16 is a night view in this room, depicting one of the lighting units.

An interesting feature of the lighting of the directors' rooms is the desk lamps provided to supplement the general lighting, if required. Each of these takes the form of a terrestrial globe, mounted on a richly ornamented pedestal of "Silveroid," bronze, or inlaid ebony, and on the globe the general land masses, in high relief, are flashed white, while the oceans are etched and comparatively transparent, and the British possessions are coloured red. A daylight lamp is used in each globe.

The main refectory on the Millbank front on the 8th floor is over 200 ft. long and 40 ft. wide, forming, it is claimed, the biggest restaurant in London. Its high barrel ceiling lends itself perfectly to cornice lighting, and it is claimed that the system employed is the best example which has yet been designed. A departure from the normal blue lamps is made here. Clear lamps are contained in special reflectors concealed in the cornices, and the daylight effect is obtained by reflection from the coving of the ceiling, which is partly tinted blue. The ornamental mouldings of this ceiling stand out in bold relief, and the backgrounds of Wedgewood medallions are accentuated by a green tint, greatly enhancing their appearance when illuminated. The natural lighting of the refectory is by means of lunette windows, which are spaced at intervals high along the inner side, breaking into the coving of the ceiling. Through these lunettes flood-lighting fittings project light from outside. The effect, fig. 14, is novel and pleasing, and the shadows from the glazing bars of the lunette windows heighten the illusion of sunshine. The average illumination in the refectory is about five foot-candles.

The directors' dining room carries two stained-glass domes through which light is projected. In this posi-



g. 2.—Refrigerator Compressor; 140-h.p. Motor.

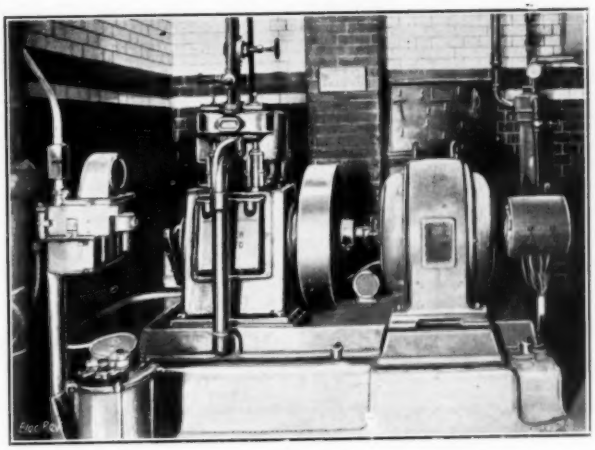


Fig. 3.—Motor-driven Well Compressor.

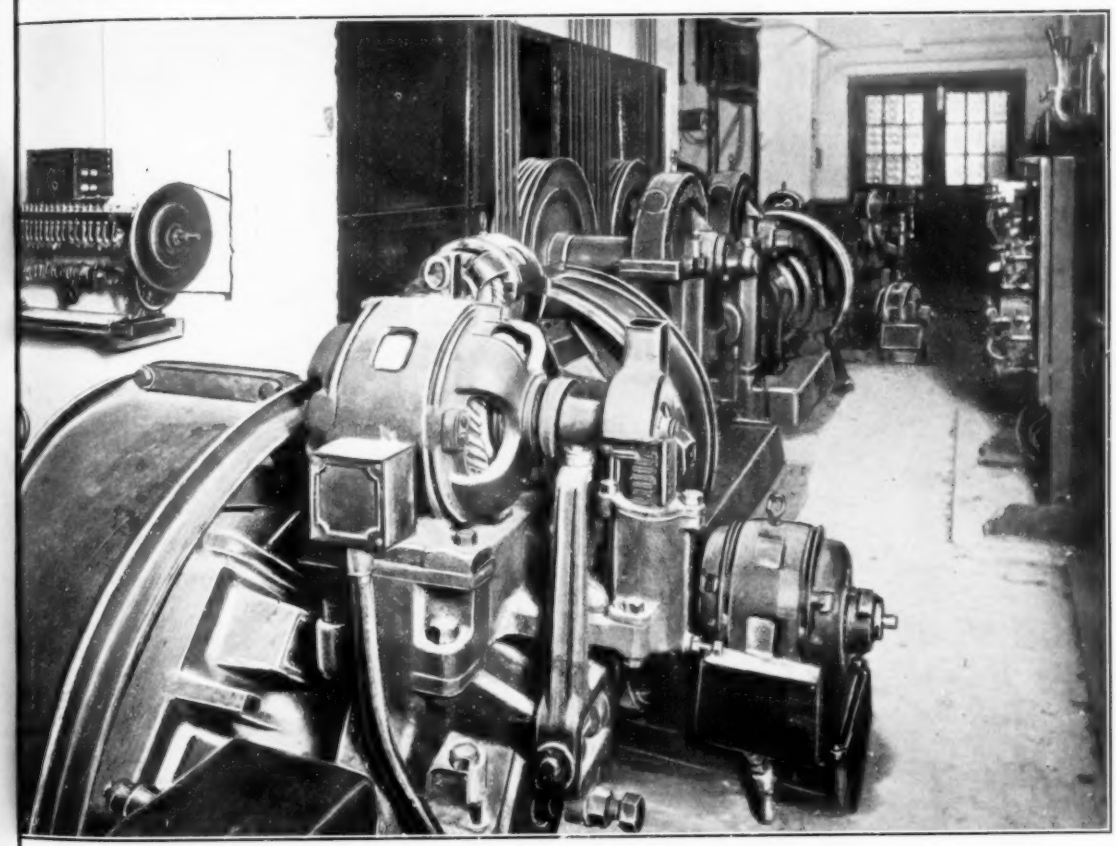


Fig. 4.—Winding Engines for Bank of Lifts; High-speed, Internal-resistance Motors.

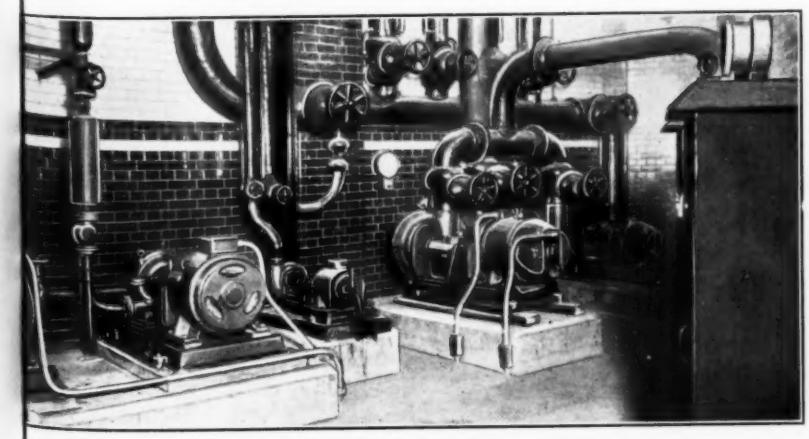


Fig. 5.—Water-circulating and Roof-tank Pumps.

Fig. 6.—Sewage Equipment.

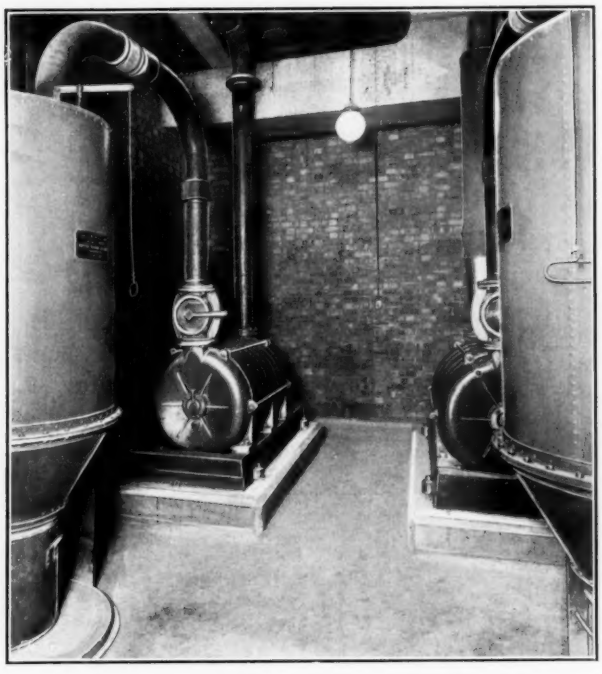


Fig. 7.—Electric Vacuum Cleaning Plant.

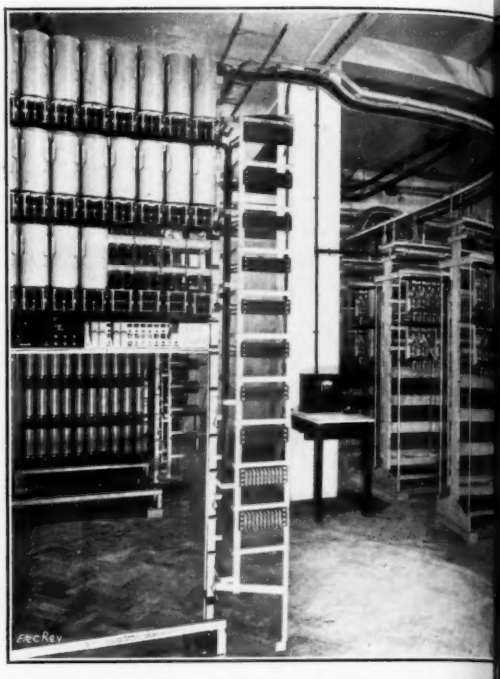


Fig. 8.—Automatic Telephone Selector Equipme

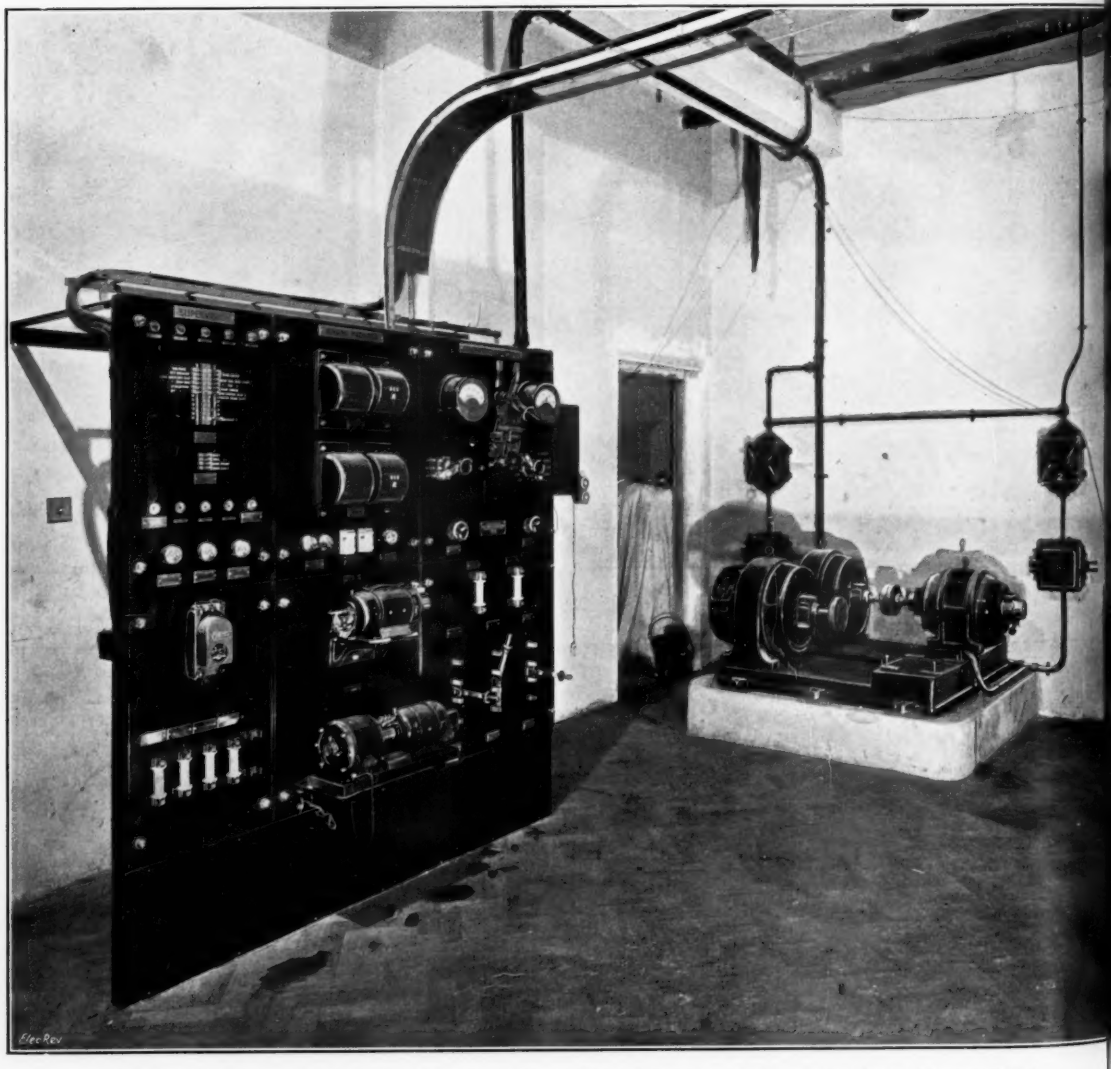


Fig. 9.—Automatic Telephone Room; Power Switchboard and Charging Sets (Incomplete).

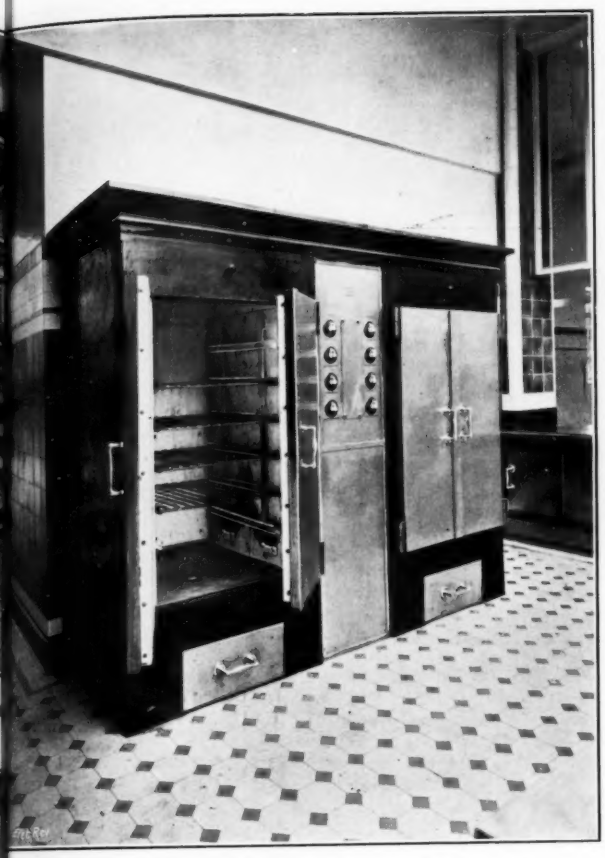


Fig. 10.—Electric Roasting Ovens; 15-kW each.

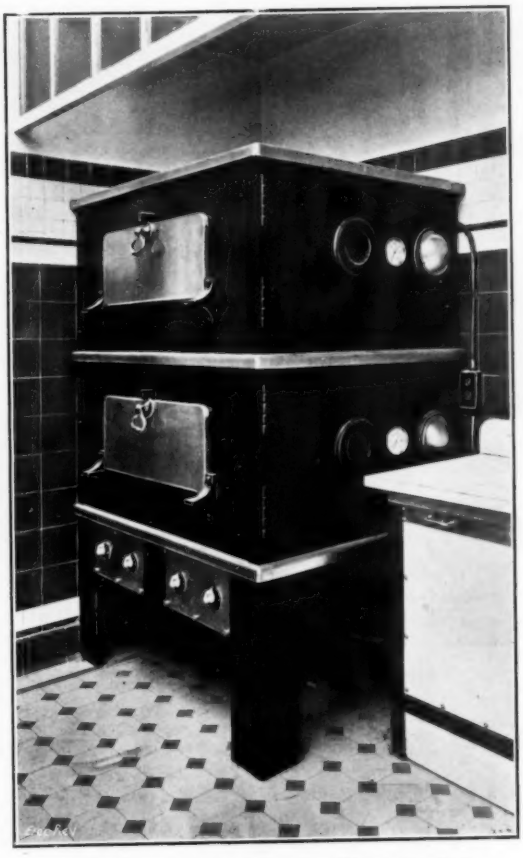
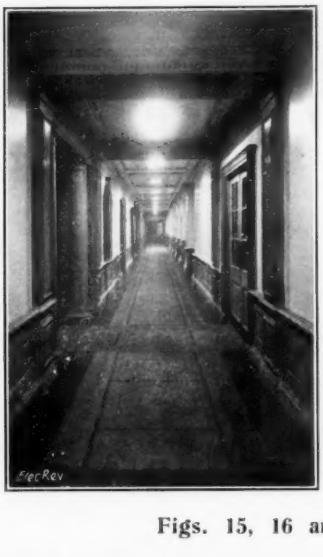


Fig. 11.—Pastry Oven; 12-kW Loading.

Fig. 12.—Service Corridor; Carving Tables, &c.

Fig. 13.—Court Floodlighting.

Fig. 14.—The Refectory; Cornice General Lighting with " Flood " Projection Through Windows.



Figs. 15, 16 and 17.—Lighting Effects in Corridor, Board Room and Staff Office.

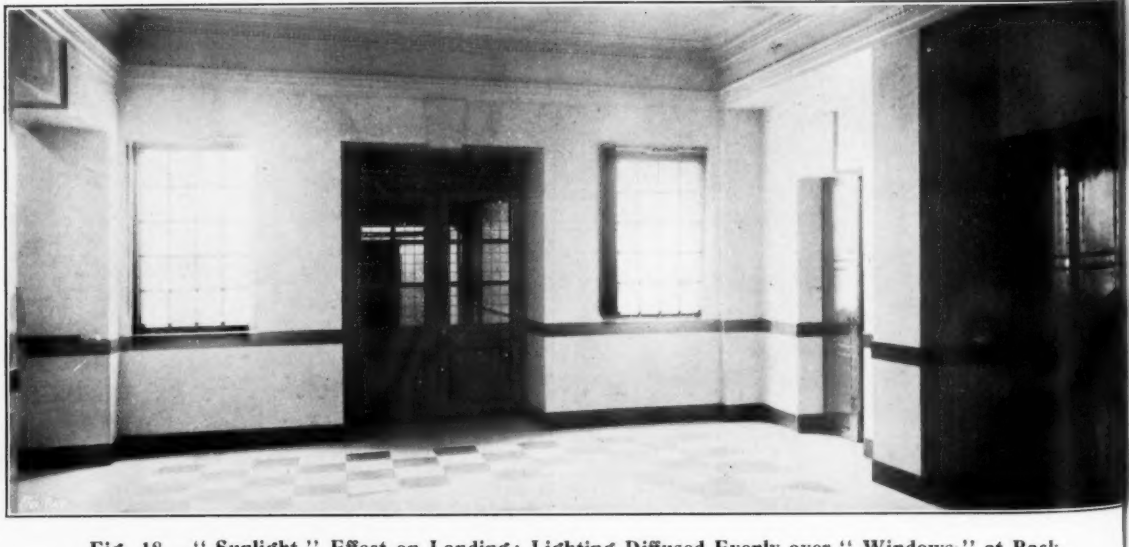


Fig. 18.—" Sunlight " Effect on Landing; Lighting Diffused Evenly over " Windows " at Back.

tion a mixture of clear and blue lamps was found to give the best results, as the tinting of the glass exerts some corrective influence. In the main kitchen, where good illumination both by day and night is of exceptional importance, the standard lighting units are freely used, supplemented where required by bulkhead fittings. The lighting of the stately colonnades, which rise at the 6th floor level on both the Millbank and Horseferry Road fronts and stand out in bold relief at night, is carried out by means of lamps housed in glazed recesses above each column, thus silhouetting the columns against the illuminated inner wall. Imperial Chemical House is planned around three main inner courts, the walls of which are tiled. These courts are brilliantly illuminated at night by means of special flood-light reflectors at ground level. The illumination of the walls is remarkably uniform, fig. 13. The illustrations of the lighting effects, figs. 13-18, are reproductions from untouched photographs.

A service of uniform and accurate time has been installed on the "Synchronome" system of electric clocks. The "controlling pendulum," or master clock, is rigidly fixed to a main wall in the basement. The outstanding feature of this installation is that there is only one master clock for the whole building, although it will have to carry a load of over seven hundred electrical-impulse dials. We understand that no relays are used, and that the working is effected by a special method of parallel grouping under which the benefits of the compensatory action of the Synchronome switch are retained throughout. The work has been carried out by the Synchronome Co., Ltd.

The wiring of the building for lighting, power, heating, cooking, bells and telephones, and the fixing of the switchboard and most of the control gear were carried out by Messrs. T. Clarke & Co., Ltd. The main switchboard was manufactured by the Astral Engineering Co., and its panels are arranged in horse-shoe fashion, parallel with the walls of the switch room, a space of about 4 ft. being left behind the panels for cable connections and access. The power panels are located in the centre and flanked on one side by the heating panels, and on the other by the lighting panels. At the free ends expanded-metal doors and screens are provided. A combined audible and luminous bell indicator system having some special features has been installed, and embodies some 500 or 600 points.

We are indebted to Sir Frank Baines for his permission to publish the above details, and to members of Sir Frank's staff and various manufacturers of the equipment for their help in collecting the information.

Lampholder Design.

The Development and Testing of a New Multifold Spring Contact.

By L. G. H. SARSFIELD, M.Sc., A.M.I.E.E., A.Inst.P.

MUCH attention has been drawn in recent months to the subject of the contact between the load and the supply in plunger-type lampholders, pear switches, and the like. This is a good sign and means that manufacturers are alive to the need for improvement in these small, though vital, links between the supply company and the consumer.

The increasing demand for electrical energy for domestic appliances must be associated with, if not led by, adequate development of reliable foolproof fittings. A very poorly constructed lampholder may be lucky enough to deal with a fraction of an ampere fairly successfully. Nevertheless, the design of lampholders is now rightly being directed towards making them reliable for heavier currents, so as to give this type of fitting a larger sphere of application.

It has been indicated by the writer in previous articles* that poorly designed bayonet-type lampholders may heat up dangerously when only supplying a 40-watt lamp, and also that properly designed specimens are capable of carrying up to 5 A without undue temperature rise.

It was also demonstrated that with normally clean surfaces contact between the top of the plunger and the adaptor, or lamp, remains good as long as the spring is sound, and that the greatest contact resistance and consequently greatest heating occurs at the sliding contact between the plunger and the sleeve.

Two possibilities, therefore, presented themselves for consideration in design; either the sliding contact must be greatly improved, or it must be eliminated altogether.

As an example of the first alternative the split plunger (fig. 1a) was put forward and described.† By virtue of its tendency to expand on to the inner walls of the sleeve this afforded good contact with the sleeve, and the resulting improvement was proved by test. A lampholder developed on similar lines has also been produced commercially, and the writer's methods of test were adopted‡ to obtain evidence of its superiority over ordinary plungers.

An example of the second alternative is found in the solid or "one piece" plunger (fig. 1b) into which the lead itself from the supply is screwed, so that contact

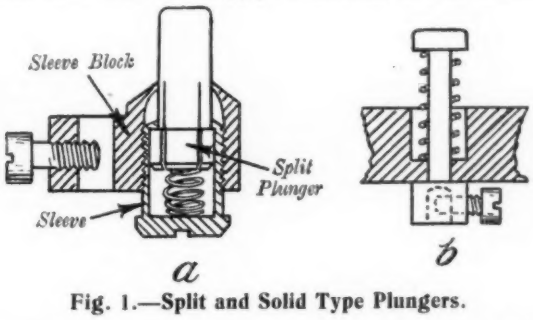


Fig. 1.—Split and Solid Type Plungers.

resistances only exist at the set screw on the supply side and between the plunger top and the lamp or adaptor terminal on the load side.

The Multifold Spring Contact.

The "one piece" type of plunger is the better proposition, since it avoids the complication of a sliding contact.

In the older models of lampholders the imperfect nature of the sliding contact meant that the enclosed helical spring was called upon to carry a large proportion of the total current. Since the spring was a steel or bronze wire of fine gauge, it was quite unable to meet this condition successfully.

A solution of the problem of this uncertain and inadequate conductivity is found in the use of a spring which combines the necessary electrical and mechanical properties.

A new "one piece" spring contact, due to Mr. H. Garde, with whom the writer has been co-operating in experimental work, not only eliminates sliding contact, but at the same time possesses additional features which

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* Electrical Review, February 13th, 1925, April 30th, 1926.
† Electrical Review, April 30th, 1926.
‡ Electrical Review, September 10th, 1926.

make it particularly suitable for heavy-current work and exacting conditions. It consists of phosphor-bronze strip formed into a multifold compression spring. Such a spring when used instead of a plunger in a lampholder is housed in a square hole and has one end of the strip extended at A (fig. 2a) to make a lug for clamping to the base block C (equivalent to the sleeve block in the common type) and the other bent over at B.

The flap B is of such length that with maximum compression the lower edge does not reach the bottom of the spring. When, however, the spring is extended to its normal height the lower edge of the flap does not emerge from the hole in which it is assembled in the insulating body of the holder, and therefore it is mechanically supported and at the same time flexible enough to secure important advantages which are discussed below.

Two plungers are shown assembled in the holder body in fig. 2b.

A set screw at D passing through the insulating body and the spring lug enters the tapped hole in the block C

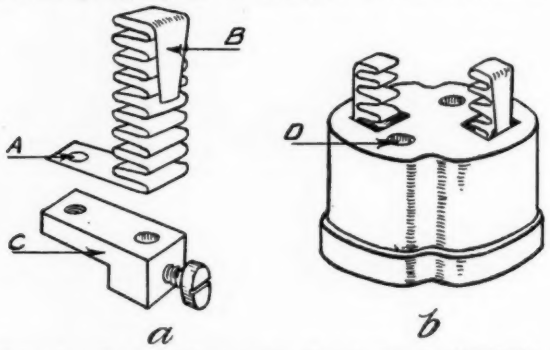


Fig. 2.—Construction and Housing of Multifold Springs.

and pulls it home in its slot on the under face of the insulating body, firmly clamping the lug in contact with the block.

With the absence of sliding contact, and having the lug end of the spring making good contact on the supply side, there remain the free end of the spring and its butt joint contact on the load side to be examined.

The Butt Joint.

It is essential in any electrical contact to have sufficient mass of material in good thermal connection with the actual area carrying the current, so that any heat developed can be conducted away. According to B. W. Jones§, who has drawn attention to the question of contact areas and pressures, contact resistance is a function of pressure and not of surface. He also shows that if there is adequate pressure and body of metal for heat conduction and radiation, a very limited area is sufficient for a very intense current density at the actual contact.

It can be seen then that a poor sliding fit between plunger and sleeve block in an ordinary plunger type lampholder not only developes heat itself due to its carrying current, but also prevents the conduction away of any additional heat which may be produced at the contact between the plunger top and the load terminal. The multifold spring, on the other hand, being a "one-piece" element constructed of heavy material having high conductivity, possesses the characteristics which are necessary for a cool joint.

The importance of all this is better realised when it is remembered that an average electrical butt joint probably consists of a few *points* in actual contact. In this connection it may be said that soft metal blobs like those on a lamp permit a certain amount of "bedding," which of course immediately increases the effective contact area.

Flexibility.

The multifold spring combines flexibility with robustness. Flexibility is a great advantage when the contact has to ride on an irregular, or oblique, surface, fig. 3a. The concertina formation of the spring allows the contact face to find a position which will give a normal pressure on the other face butting up against it. This correct alignment is effected without the tendency to jam, which is sometimes the case with other forms of plunger—see fig. 3b.

Flexibility is also of service when vibration is present, because any movement of the lamp or adaptor in the

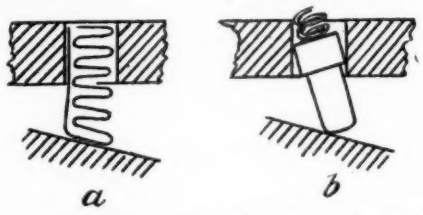


Fig. 3.—Irregular Contacts with Multifold Spring and Ordinary Plunger.

holder can better be followed by the multifold spring than by a plunger, which only has movement along one line, except at the expense of good fitting and perhaps of contact between the plunger and the sleeve block.

The multifold spring therefore lends itself to traction work.

Current-carrying Capacity.

A spring comprising eighteen folds is constructed from a strip 3.7 in. long and has a resistance from end to end (at contacts) of 0.011 ohm for a bronze having a resistivity of 6×10^{-5}.

A number of tests of current-carrying capacity have been made with springs in lampholders and for connecting other devices. No test to destruction has been made, but the following figures give proof that the contact spring is a satisfactory heavy-current-carrying element.

Fitted in an ordinary lampholder, two of these springs have for twelve months been delivering through a standard adaptor 4 A to an industrial-machine circuit during factory working hours of fifty per week. In another reliability trial two springs were mounted separately, each forming the centre contact of an Edison screw holder. One has carried 9 A for 1,248 hours on an average of six hours a day in two periods of three hours, four days a week. The other has carried the same load under the same conditions for 750 hours. In each case the spring was well compressed into the hole in the insulating body in which the contact was mounted, so that very little free radiation from the folds was possible.

From time to time the load screw was removed after a three-hour run, and the contact spring was always found to be quite cool. At the time of writing both contacts are still in operation on routine lines under these conditions.

Some Mechanical Features.

The multiple folds make the spring at once resilient and powerful. These properties are necessary for reliable electrical contact. With this design there is no risk of exceeding the elastic limit of the material, since each individual fold or bend contributes only a small fraction to any total extension or depression, and in this respect the arrangement represents an advance upon the single-leaf spring, such as is sometimes used for the centre contact of the Edison screw-type holder.

The device is easy to assemble, comprising, apart from casing and insulating body, three parts per pole (spring, base block, and set screw), instead of five (plunger, spring, sleeve, sleeve block, and set screw) as found in the familiar pattern of plunger-type lampholder.

Conclusion.

The spring has applications in a wide sphere. It is the writer's intention to discuss in a further article some operating characteristics of certain designs of small switches for domestic purposes. It is proposed also to present some results of tests of the multifold spring as adapted to this type of apparatus.

§ B. W. Jones "Contact Resistance" *G.E. Review*, February, 1927.

Agricultural Electric Machinery.—II.

A review of the 1929 Paris Agricultural Exhibition, depicting some selected items of special interest to electrical engineers.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ac.S.

IT is true that more attention has been given to electric driving in farm buildings than in the fields, so that it is not to be wondered at that at the exhibition very considerable space was devoted to the first-mentioned class of machinery.

The great majority of French manufacturers, unlike German and Scandinavian makers, still offer their standard *industrial* motors, which, of course, are not really suitable for agricultural work, especially when compared with the special types of machines developed for that work in Germany and Scandinavia. Exceptions are the motors supplied by Law, Sté. Electro-Motoculture, Eve & Noizet and Roulland The Law motor is made in two distinct types. One, of half horse-power, is intended for operating almost any kind of barn machinery by direct connection, thus eliminating flapping belts. The motor is a single- or three-phase machine for standard voltages, and incorporates a speed reduction gear. By the manipulation of a hand-wheel at the end of the motor it can be reversed, or its speed regulated from 0 to 200 r.p.m. The motor is supported on an adjustable tripod and is supplied with three couplings which enable it to drive the great majority of existing hand-operated barn machines. Its weight, mounted on a tripod stand, is 56 lb. For the operation of hand-worked machines this was undoubtedly the best motor at the Show. In larger sizes the Law motor is made with the starter forming a portion of the motor frame, which is a very convenient form of construction for farm purposes. The same motor is also made with an extended case containing speed-reduction gears with five protruding shafts which run at, respectively, 40, 60, 100, 400 or 700 r.p.m.; in addition, there is a direct drive off the armature spindle. A motor of similar type is manufactured by Messrs Ransomes, Sims & Jefferies. A cheaper and very effective motor, not unlike the small-type Law motor, was displayed by the Sté. Electro-Motoculture. In this case a simple friction drive is adopted in place of the more expensive and complicated reduction tooth gearing. The efficiency of the transmission is not very good, but undoubtedly it serves its purpose since it is only used for a short time each day. It is very much to be doubted whether all the varieties of speeds noticed are really required by the average farmer, as most barn machinery can be very satisfactorily operated at 110 r.p.m.; in fact, in Germany this speed has been standardised.

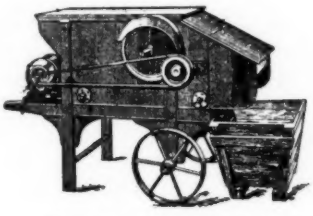


Fig. 1.—Portable Food-mixing Machine.

The Eve & Noizet motors are of unique construction; both the motor and reduction gear are contained within an outer rotating body forming step pulleys like a lathe. A new application of this motor which was shown provides for the operation of a cart loader; the motor is placed at the lower end of the loader and employs a single wide belt. The usual lengthy chain drive is dispensed with, and the combined motor and pulley forms a very compact end to the elevator.

The Roulland motor, which is constructed with open ends for ventilation purposes, is specially designed to resist dust, and one working model was shown under a glass case, half buried in a heap of sawdust which was being stirred up and passed through the machine. Working under such conditions is achieved by the use of three slip rings which are mounted directly at one end of the armature instead of in the usual position. In the case of the squirrel-cage type motor the conductors are made of white metal cast into the core of the armature.

Coincident with the exhibition a report has just been issued by the Union des Syndicats de l'Electricité, on tests on French agricultural motors. The machines upon which the tests were made were all exhibited at a previous exhibition and were briefly referred to in the Electrical Review of March 4th, 1927, p. 332. Those who are specially interested in the design of agricultural electric motors cannot do better than obtain a copy of this Report, which is available from the Union at 25, Boulevard Malesherbes, Paris (8e).

A large number of electrically-driven cream separators was on view, but the greater portion still has a separate motor drive, and for this class of construction there is nothing to beat the British Lister machines. However, as in other industries, the properly incorporated electric motor is pretty sure to be the eventual model. Examples of this type of machine are the Persoon and the Melotte. The best apparatus from the farmer's point of view is the Stiemel combined separator, churn and butter worker. This is a directly-driven equipment with a built-in electric motor; hence it is a very easy machine to keep clean and a most convenient one for the farm.

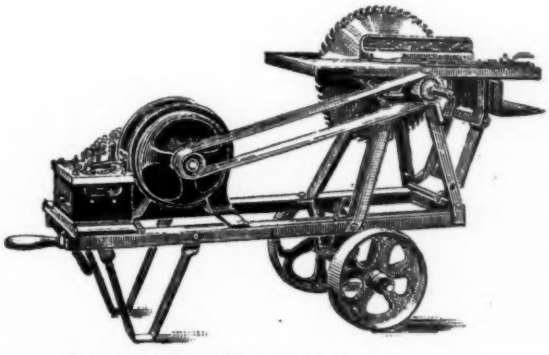


Fig. 2.—Mouzon Portable Saw; 1½ h.p.

In spite of the availability of cheap labour, the use

of milking machinery is rapidly spreading on the Continent. Several makes, *e.g.*, the Dana, Melotte, and so on, are not yet available on the English market, whilst others are marketed under different names. A thorough examination of the various types leads one to wish that the best details of each could be incorporated into one machine. In that cows have not to be stripped (*i.e.*, the last small portion hand milked) with the Dana equipment, this is ahead of the others. The Titania has only a single moulded piece of india-rubber to form the teat cup, which greatly facilitates cleaning. The Alfa-Laval Co., which has replaced a portion of the rubber tubes with metal ones, demonstrated the alterations of the suctions in the two pairs of cups, which formed the complete set of four, by aid of coloured electric lamps, so arranged as to make contact and light up as the suction took place. For the tenant farmer the portable Ford and Hinman milkers were very attractive with their self-contained electric motors. They only need to be connected to the nearest wall-socket or lampholder.

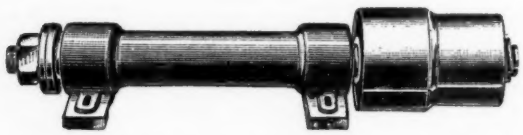


Fig. 3.—Ball-bearing, Saw-bench Countershaft.

Hitherto food-mixing machines have been somewhat prohibitive in cost, but some new and less expensive ones were exhibited. Fig. 1 shows a portable model. It weighs 2 cwt. and has an hourly output sufficient for 20 to 30 head of cattle, or 200-300 sheep. It is driven by a ½-h.p. electric motor. A stationary machine is equipped with a 1.5-h.p. motor and has an hourly output sufficient for 80 to 100 cattle, or 800 to 1000 sheep; its weight is 7 cwt.

Disintegrators are tending to become more popular, and on account of their high speed of operation they lend to electric driving. Rather large motors, 10 to 15 h.p., are required. With the larger motor nearly 1½ tons of oats can be crushed per hour. Of machines of this class shown the Utica is probably the best.

In England the bascule type of saw is unknown, though it is very common on the Continent. The use of Y forks for the sawing of logs is certainly much to be commended from the safety point of view. Fig. 2 shows a 1½-h.p. Mouzon portable saw of this type which was seen at the exhibition. A new design of angle-steel saw bench with grips for sawing planks off small logs was shown by Duchêne. In the construction of portable electric motor equipment ball-bearing countershafts of the saw-bench spindle type are very useful. One of the Duchêne make is shown in fig. 3. A number of directly-coupled electric blacksmith forge-blowers were on view, though they were not any advance on British practice.

Though the use of manure and fodder overhead carriers is increasing on British farms, the same cannot be said of hay and corn hoists. In France, while the use of automatic grip-fork overhead transport is largely employed, the German and Scandinavian practice of dealing with complete cartloads at one lift is not so well known. Naturally, this method economises a great deal of time during harvest periods.

The Société Général Agricole exhibited a model of the author's system of making hay without sunshine. This and various methods of crop treatment are now handled in Great Britain by Sugar Beet and Crop Driers, Ltd.

A very large number of makes and types of pumps were on view, the great majority of which were electrically operated. The popular pump to-day is one equipped with a 1/3- or 1/4-h.p. motor, with an automatic controller which keeps a pressure tank full (except for the air cushion, which is an important feature of the system). This enables a supply of water to be piped over the farm-buildings and house, and at each faucet a supply at 30 or 40 lb. per sq. in. can be obtained, *i.e.*, a replica of a city service. The automatic controller employed on this equipment is that adopted by a great number of automatic pump-makers—the E.M.A.

There appears to be quite a demand for portable pumps. Fig. 4 illustrates a typical example of this type, for use in market gardens and on wine-making farms, made by Carouelle. The counter-weighted jockey pulley should be noted, as it is a method often employed on the Continent for keeping belt drives at a uniform tension.

In a wine-making country, naturally there were a number of ingenious devices for electrically operating the screws of grape and cider presses. The Garnier was a very good practical example of a very convenient electrical application for this purpose.

The all-metal washing machine has ousted the wooden type in France. The construction and cost are simpler and lower, respectively, than is the case with machines offered for sale at home. There is no doubt that the type of machine sold in England is of much better workmanship, but the price is such that they are not purchasable by the great majority of housewives. Hence there should be a good field here for those of the French pattern. Several new electric drives were on view, but none of them seemed to come up to the standard of the Birum. A difficulty in designing a washing machine drive is the necessity for reversing the clothes drum every eight revolutions, so that the clothes being washed do not get hopelessly and tightly tangled together.

A number of oil engines were staged, but of course the French farmer is not so dependent upon their aid as is the case with the British agriculturists. A noteworthy feature of the trend of design was the square and clean external appearance of most of the patterns. A large proportion were designed for the use of heavy oil. Particularly interesting engines were the C.L.M. (Peugeot patents) and Renault high-speed Diesel prime movers

While there was nothing of outstanding novelty at this Exhibition, great progress has obviously been made in detail design, and it is self-evident that applications of electricity in agricultural operations are steadily increasing in France. Chilling, case-hardening and heat-treatment processes are being partially superseded by electric-furnace steel, as made by such concerns as Sté. Amouroux Frères. Otherwise the workmanship is characteristically that of the typical agricultural engineer of all countries, even down to the bright and gaudy paint-work. Still, it is encouraging to note more and more demand for the products of the electrical engineer to aid in the operation of the aforesaid brightly beautiful barn machinery.

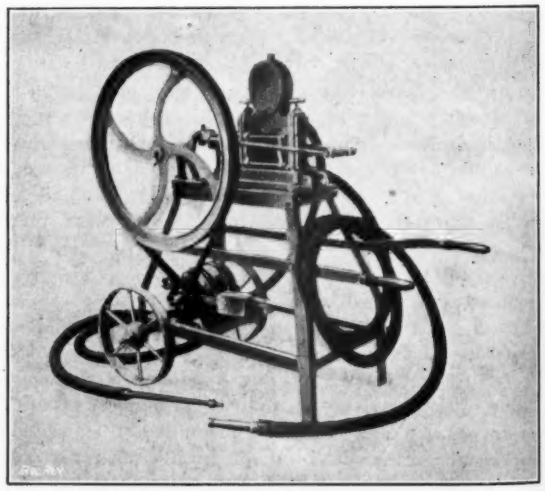


Fig. 4.—" Carouelle " Portable Electric Pump.

Architectural Lighting.

New Exhibits at the London Lighting Service Bureau.

During the past year the London Lighting Service Bureau, Savoy Street, Strand, W.C., has been re-arranged and at least two new exhibits have been added to the admirable and interesting display of appliances and systems for correct illumination which is maintained there.

Fig. 1.—An Architectural Lighting Apartment.

These innovations are in the field of architectural lighting, dealing with the exterior and interior aspects of the matter. As regards the first aspect, the subject has been combined with the more general problem of street lighting.

An architect has been added to the Bureau staff to study architectural lighting problems and to design the best means of dealing with them. One of his tasks has been the arrangement of an apartment (fig. 1) in which various systems of interior illumination are treated with particularly pleasing results. The greater part of the ceiling consists of a panelled octagonal skylight of diffusing glass above which are alternative white and orange lighting systems. Between the top of the walls and the ceiling there is a set of concealed lights giving ample indirect illumination supplementing or replacing that from the skylight. In the upper parts of the walls are two continuous channels covered in with glass panels. These naturally form a part of the decorations, but they can also be employed to light the apartment, lamps being fitted behind the panels. Below these bands the walls are broken into recesses and the lintels of the latter are composed of moulded glass in removable sections and thus provide another means of illumination. It should be emphasised that all the systems actually form parts of the room; in no sense are they additions to the design. Supplementing these general lighting systems there are several ingenious examples of detail lighting such as a French doorway of diffusing glass, wall brackets, appliqués of modern design, a lighted mirror, &c.

An ingenious model street has been prepared in which typical modern buildings are represented on a scale of ½ in. to a foot. The street thus reproduced to scale is 215 ft. long, but by means of a mirror at the end this is doubled; the street width is 50 ft. and the pavements at each side are 18 ft. wide.

The demonstration of the model commences with an exposition of the inadequate illumination usually provided under restrictive street lighting contracts, showing how little light is thrown upon the buildings and how dismal is the general appearance of the street at night. This stage is illustrated in fig. 2, where converted gas standards spaced at 40 ft. and bearing one 100-W lamp each are employed. The next stage shows the improvement effected by substituting higher columns with 200-W pole-top units on the same spacing. The change is carried out by sinking the standards in position below the pavement level, turning a handle to another position and raising the new set. Proceeding, a system employing 20-ft. columns with distinctive lanterns, spaced at 50 ft., with 1,000-W lamps is shown. The next development is the use of three-light pole-type

Fig. 2.—An Inadequately Lighted Street.

Fig. 3.—Improved Street Lighting.

units on 20 ft. columns, spaced at 50 ft., with 300-W lamps. This phase is illustrated in fig. 3, from which the great improvement in both ground and building-front illumination will be observed. The slightly brighter appearance of the top of one of the buildings on the left-hand side is due to the flood-lighting employed on it. The fifth system demonstrated consists of the illumination of the standards seen in the centre of both illustrations; these bear dispersive lanterns equipped with 1,000-W lamps. Each of the four kerb-line arrangements is so wired that three different spacings can be demonstrated, expanding the usefulness of the model. Moreover, lighting features are incorporated in the shop windows, some of the upper windows, &c. A number of ingenious details make the model street very "true to life."

To use the accepted phrase, the new developments "must be seen to be appreciated," and we urge all who are interested in architectural and street lighting—as buyers or sellers—to pay an early visit to the Bureau.

Reviews.

Underground Cable Systems. By G. W. Stubbings. Pp. vii+216; figs. 106. London: Chapman & Hall, Ltd. Price 15s. net.

In this book, the author deals with both the construction and maintenance of underground cable systems from the source of supply to the consumers' premises, and he is to be congratulated on producing such a volume of information in so small a book.

The technical data is given in such a way as to be easily followed and understood by the technical staff of a supply undertaking, as well as by the electrical student who has passed the elementary stage.

No section or phase of distribution of electricity by underground cables has been omitted, but the author could have devoted, with advantage, a few extra pages in Chapter V to cable jointing, by giving details (supplemented with one or two illustrations) of joints on 3-core cables, for working pressures up to 11 kV.

In Chapter VI the author mentions that a large number of electricity supply corporations and companies have extensive feeder networks of 6.6 kV or 11 kV, and every mains engineer and his staff would appreciate data relating to the latest methods of jointing these cables.

Mention is made in Chapter V of cast-lead sleeves being used as an alternative to ordinary split lead sleeves made from extruded tubing or rolled sheet lead. As cast-lead sleeves, where there is a possibility of their being subject to vibration, are liable to become porous through disintegration of the metal, sleeves made from extruded tube or rolled sheet lead are recommended as being more reliable.

The subject of location of cable faults is fully treated so far as well developed faults are concerned. An outlined procedure for locating an obstinate high-resistance fault which only manifests itself occasionally would have been useful.

In dealing with cables for extra high pressures, considering present-day knowledge and existing literature, the author has expounded the old stress theories at greater length than necessary. A more comprehensive bibliography would have been an advantage. The more recent knowledge of e.h.p. cables is ably expressed, but an important omission is a reference to 66-kV and 132-kV oil-filled cables, examples of which have been in successful operation for some time.

A useful synopsis of protective systems in Chapter XII might well have been amplified with additional diagrams and operational data and by the inclusion of more references to current literature.

Chapter XV deals all too briefly with such an important subject as "Tests and Measurements," and here again an extensive bibliography would have considerably enhanced its value.

There are one or two misprints in the book, but these are so apparent that they can be ignored.

The Radio Manual. By George E. Sterling. Edited by Robert S. Kruse, B.S. Pp. vii+666; figs. 273. Third Printing. London: The Library Press, Ltd. Price 30s. net.

This is a comprehensive manual of the theory and practice of radio communication for the use of radio engineers, inspectors, students, operators, and experimenters. The author is a Government radio inspector in the United States of America, and the editor is a well-known American writer on radio signalling, formerly technical editor of the magazine of the American Radio Relay League, a leading amateur organisation. The book, which is well written and well produced, may therefore be considered as authoritative as regards practical work, from both the professional and amateur points of view. It is indeed a sort of "vade mecum" for all those interested in the subject from the American standpoint, and will be useful in this country as a guide to American practice, commercial, broadcasting and amateur.

As a text-book for the ordinary student, this Radio Manual suffers from its comprehensiveness. It covers far too much ground for that purpose, but as a book to be studied and used for reference by professional wireless workers, and to a much less extent by amateurs, it will no doubt be welcomed in the United States, and by those over here who wish to be acquainted with the general outlook, and the details in practice, of wireless work in America.

The book is elementary in the sense that it is not mathematical, and indeed assumes no previous knowledge of electricity, the first hundred pages being devoted to a summary of the theory of this subject. From that it launches straight off into the theory and practice of the oscillating valve, both as a receiver and as a transmitter. This subject is dealt with very fully; the practical portion, however, being confined to American installations in land and ship stations. This is followed by a detailed description of American broadcasting equipments. Arc and spark transmitters are then considered less fully, much less so on the theoretical side. Chapters on various commercial receivers, beacons and direction finders follow, and there is a thirty-page chapter on amateur short-wave apparatus. The book closes with a summary of the wireless regulations in the United States, the international regulations which came into force this year, and, happily, an index.

Electric Wiring. Eighth Edition. By W. C. Clinton, M.I.E.E., and E. H. Freeman, M.I.E.E. Pp. ix+260; figs. 96. London: John Murray. Price 4s. 6d. net.

The fact that an eighth edition of this little work has been called for is indicative of its utility to wiremen and students, for whom it was originally written. In preparing this edition, the authors have carried out a thorough revision to bring the work thoroughly up to date, and it has been strengthened by the addition of a chapter dealing with elementary a.c. theory.

The book may be divided into two parts, the first dealing with the elementary principles of electrical technology and with simple electrical calculations, and the second with the subject of wiring and installation work in its practical branches.

In the first part of the book a praiseworthy attempt has been made to inculcate exact notions regarding the fundamentals of electrical calculations. The authors are careful to state, for instance, that the proportionality between current and voltage in a circuit, which is usually known as Ohm's law, only holds generally if the temperature remains constant. The calculation of series and parallel circuits is explained with great clearness, and with the aid of many worked examples.

We doubt if the authors have been quite so successful in their new chapter on alternating currents. Inductance is perhaps better described as a factor connecting rate of change of magnetic flux with induced voltage, than in terms of the energy stored in a magnetic field. The authors have built up their teaching of power factor on a consideration of the impedance vector triangle. It may be useful to define power factor as the ratio of resistance to impedance, if the subject is in process of gradual development, but this definition is not very useful to practical men, whose experience with low power factor is in connection with motor circuits. The notion of wattless current is one which can be assimilated with fair success by those whose elementary training is not very sound, and by the use of this conception it is not difficult to obtain a clear notion of the meaning of power factor, and of the methods by which it may be improved. The reference to the two-phase, three-wire system of distribution seems quite superfluous.

The second portion of the book, dealing with wiring systems and wiring accessories, invites criticism, although it is admittedly difficult to make a judicious selection of the numerous aspects of such a wide field, when writing a small work. The account of the modern systems of surface wiring seems somewhat meagre in comparison with the considerable space devoted to the subject of jointing cables. Although the important subject of earthing is accorded a complete paragraph, and the reason of the necessity of earthing is clearly explained, some practical notes on the running, connecting and testing of earthing connections would have been very acceptable in a work of this character. The subject of wiring accessories is treated very well, and there are some useful notes on the planning of lighting installations. There are very good chapters on electric bell installations and on testing and testing sets. The chapter dealing with motors needs some revision in the references to induction motors. The reference to the cage rotor type on p. 236 is misleading, as it implies that a wound rotor is connected to the supply mains through the slip rings and brushes.

The book can be generally recommended as an inexpensive and comprehensive little manual, the utility of which is greatly increased by the profusion of the worked numerical examples which it contains.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Two Important Committees.

Last week-end the Electricity Commissioners announced the appointment of two committees to deal with matters of outstanding importance to the electrical industry. The object of the first committee is to "consider what steps can be taken to ensure that facilities for assisted wiring and for the hire and/or the hire-purchase of apparatus are made available, wherever needed, to prospective consumers of electricity in rural and other areas of supply, and to make proposals for a practical financial scheme for the purpose." The committee consists of Mr. Ll. B. Atkinson, representing the Cable Makers' Association; Mr. H. Bentham (Provincial Electric Supply Association); Mr. S. E. Britton (Incorporated Municipal Electrical Association); Mr. D. N. Dunlop (British Electrical and Allied Manufacturers' Association); Mr. J. T. H. Legge (Incorporated Association of Electric Power Companies); Mr. H. Marryat (Electrical Contractors' Association); and Lieut.-Col. W. A. Vignoles, D.S.O. (British Electrical Development Association). The secretary is Mr. E. W. Dickinson.

The purpose of the other committee is "to consider the various kinds of charges and tariffs offered by authorised undertakers in connection with the supply of electricity for lighting, domestic, office, and power purposes, and to make definite proposals whereby a greater measure of uniformity in respect of charges and tariffs can be brought about in the electricity supply industry." The members are as follows:—Mr. H. Bentham (Provincial Electric Supply Association); Mr. A. C. Cramb (I.M.E.A.); Mr. J. T. H. Legge (Incorporated Association of Electric Power Companies); Mr. F. W. Purse (London and Home Counties Joint Electricity Authority); and Lieut.-Col. W. A. Vignoles, D.S.O. Mr. C. E. Allan is secretary.

Central Electricity Board Contracts.

In our last issue we briefly reported the placing of contracts valued at £3¼ millions by the Central Electricity Board.

British Insulated Cables, Ltd., informs us that its contract is for the supply and laying of approximately 90 miles of single cable for 66,000-V working, 30 miles of three-core cable for 33,000-V working and 15 miles of auxiliary cables. The approximate value of the order is £350,000. These cables will be laid in the following London districts, the total length of route being 25 miles:—Islington to St. Pancras; St. Pancras to St. Marylebone; Poplar to West Ham; Willesden; West Ham to link up with proposed overhead lines from Barking; East Ham to link up with West Ham to Barking cables; Kidbrooke to Woolwich; Fulham to Wandsworth; Battersea; and Wimbledon to Kingston.

The route covers densely populated parts of London, and well over 1,000 joints will be necessary. The contract involves approximately 500 tons of electrolytic copper, 1,500 tons of lead, and 250 tons of galvanised steel wires. The first portion of the order is to be ready for work by the end of September, 1929, and the whole contract is to be completed by September, 1931.

A Sound-Film Merger.

Two important German firms engaged in the production of talking films and equipment—the Tonbild Syndikat and the Klangfilm—are merging their undertakings, which represent a total capital of about £20,000,000. The Klangfilm A.G. is associated with the A.E.G. and the Siemens-Halske concern, while the Tonbild Syndikat represents, among others, the British and French Phototone Companies.

The Polish Electrical Industry.

In consonance with the country's small requirements, the Polish electrical manufacturing industry was only on a small scale prior to the war. During the past ten years, however, various works have been established and these now employ about 6,000 workmen and staff. In the main these works are promotions of foreign groups, including German firms. They produce electrical machines of small and medium size, apparatus, installation material, glow lamps, accumulators, electro-medical appliances, low-pressure equipment, and broadcasting apparatus. So far there is no production of meters, steam turbines, large generators, or h.p. apparatus, but as they will be largely required in connection with the extension of the supply of electricity, it is said that these manufactures will afford a good field of activity for foreign firms. The German firms who have embarked on production in Poland are as follows:—The Siemens concern, with its subsidiary the Polish Siemens Works; Brown, Boveri & Co. with two works; the Giesche Co. which produces electrical porcelain; the Osram Co.; and the Accumulator Co. Low-pressure works are almost entirely lacking. The only large works for the production of l.p. apparatus is that of the State which makes telephone and telegraph equipment.

The B.T.H. Ex-Service Association.

That war-time comradeship is still remarkably strong in Rugby is demonstrated by the B.T.H. (Rugby) Ex-Service Association, which has enrolled over a thousand members—about one-sixth of the employés of the main works of the British Thomson-Houston Co., Ltd. We have received a photograph of a group of 638 members. The Association is active in many ways, and besides running various social events for the benefit of members, is now turning its attention to helping local charitable institutions having no direct connection with the B.T.H. Co.

Ideal Home Exhibition Luncheon.

A luncheon was given by the Household Appliances Section of the London Chamber of Commerce on March 12th at the Clarendon Restaurant to Mr. F. E. Gordon, organising manager of the Ideal Home Exhibition. In proposing the toast of "The Ideal Home Exhibition," coupled with the name of Mr. Gordon, Sir William Bull, M.P., said that since the first exhibition was held in 1908 there had been a steady increase each year in the number of visitors, and last year the total reached 540,000. A great deal of the success of the exhibition was due to Mr. Gordon, who had been the organiser since 1924. Mr. Gordon, in responding, said that the chief difficulty experienced by the organisers was to think of new ideas to maintain the popular interest in the exhibition. The toast of "The Household Appliances Section of the London Chamber of Commerce" was proposed by Mr. G. H. Grimaldi, who said that in studying the aims of the section, he noticed that no provision was made for the education of the retailer. The retailer was the weak link in merchandising, and it was important that the wholesaler should commence an agitation in the retail trade and educate it in the art of salesmanship. In reply, Mr. G. E. W. Crowe said there was a tendency for the salesman to criticise competitors rather than to sell the idea. If he would only concentrate on the selling of the idea, then he would increase the demand for his products. Mr. E. W. R. Stapley proposed "The Guests," and Sir William Arbuthnot Lane responded.

The American G.E.C. in Russia.

It is reported from Moscow that the State Electrical Trust has entered into a new agreement with the American General Electric Co., under which the latter has undertaken to supply plant to the value of $26,000,000 on the basis of five years' credit. The new agreement is said to give the Soviet trust the right to utilise all the patents of the American company and to appoint specialists in the latter to responsible positions in Russia. It is possible that this has reference to the series of contracts spreading over six years to which we referred in our issue of December 7th, 1928 (p. 965).

"Cambridge" Instruments at the B.I.F.

The Cambridge Instrument Co., Ltd., informs us that it was the maker of the automatic temperature control equipment fitted to the furnaces types "M.F.12" and "A.T.O.2" shown at the British Industries Fair, Birmingham, by Wild-Barfield Electric Furnaces, Ltd. The company's automatic regulator was illustrated on the panel on the left-hand side of fig. 26 on page 398 of our issue of March 1st. The company also supplied the automatic temperature control which was mentioned in connection with the exhibit of Birmingham Electric Furnaces, Ltd., on p. 399 of the same issue.

Swedish Automatic Telephone Patents.

It is announced from Stockholm that the patent action pending since 1924 between the American Telephone & Telegraph Co. and the Swedish Ericcson Co., with regard to the automatic telephone, has been decided in favour of the Swedish company.

Bankruptcy Proceedings.

J. M. Longe, 1, Queen's Gardens, Lancaster Gate, W.—An application was made to Mr. Registrar Francke on March 15th at the London Bankruptcy Court for an order of discharge on behalf of this bankrupt who failed in April, 1926. The Official Receiver reported that the estate had realised £190, and a dividend of 3d. in the £ had been paid on provable debts aggregating £8,866. The applicant began business in 1920 in partnership with two others, as manufacturers of electric lamps, under the style of "The Eclat Electric Lamp Co." The bankrupt estimated his losses on the partnership at £7,000; his late partners should have contributed £5,000 towards that amount, but he had not returned them as debtors to his estate because he was of opinion that the debts were irrecoverable. In January, 1923, the bankrupt purchased the "Spencer Lamp Works" and the "Standard Lamp Works," at Wimbledon, for £8,000. He carried on those concerns under management for six months, when they were taken over by "The Eclat Electric Manufacturing Co., Ltd.," registered in July, 1923, with a nominal capital of £500. The company issued first debentures to the mortgagees of the property, and a second debenture for £13,500 to himself as the purchase consideration for the business. He became a director of the company and a year later obtained for it a loan of £11,000 from his bankers against securities worth £9,000, and a guarantee of over £3,000 from the petitioning creditor. Early in 1925 owing to default in the payment of interest, first debenture holders obtained the appointment of a receiver and the bankrupt's second debenture produced nothing whatever. Towards the end of 1925, an order to discharge the loan of £11,000 obtained from the company's bankers, the bankrupt's securities were sold and the petitioning creditor was called upon and paid a certain amount under his guarantee. He next called upon the bankrupt to fulfil his obligations to reimburse the amount so paid, and in default of payment instituted bankruptcy proceedings. In September, 1923, the bankrupt registered, and became a director of "The Eclat Electric Accessories (Paddington) Co., Ltd." This concern also proved a failure, a receiver was appointed, and at the date of the receiving order in April, 1926, the company was moribund. The only fact reported by the Official Receiver in opposition to the application was insufficiency of assets to equal 10s. in the £ on the amount of the liabilities. His Honour granted a discharge subject to a suspension of four weeks.

H. H. D. Radcliffe and F. Haddleton, trading as "City Electric Services," 51, Islington Row, Birmingham, electrical engineers.—The public examination herein was held on March 13th at the Court House, Birmingham, when a statement of affairs was presented showing liabilities of £489 and a deficiency of £332. The debtors attributed their failure to insufficient capital, loss on contracts, and excessive drawings of partners. The debtor Radcliffe commenced trading in January, 1927, and was subsequently joined by Haddleton, who invested £150 on a partnership basis. The business had never yielded sufficient to meet the partners' drawings. The examination was closed.

F. E. Care (F. E. Care & Son), dealer in electrical goods, &c., 40, Paradise Street, West Bromwich.—First meeting held March 21st, at the Official Receiver's office, 191, Corporation Street, Birmingham. Public examination, April 5th, at the Law Courts, West Bromwich.

S. Hall (E. Green & Co.), electric lamp dealer, 13, Caledonian Road and 30, Leighton Lane, Leeds.—First meeting March 25th, at the Official Receiver's office, 24, Lower Bond Street, Leeds. Public examination, April 9th, at the County Court House, Leeds.

G. M. Wilshaw and G. Sharpe (Wilshaw & Sharpe), electrical dealers, 320, Padiham Road, Burnley.—Last day for proofs for dividend, March 29th. Trustee, Mr. J. W. Carter, Official Receiver, District Bank Chambers, Blackburn.

H. C. Sharpe, wireless engineer, late of 42, Molesworth Street, Wadebridge.—Last day for proofs for dividend, March 30th. Trustee, Mr. T. Barton, Official Receiver, City Chambers, Catherine Street, Salisbury.

E. D. Jones, electrical engineer, Royal Sportsman Hotel, Portmadoc.—First and final dividend of 1s. 5d. in the £, payable April 9th, at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

Company Liquidations.

Mouldings and Insulators, Ltd.—A meeting of creditors will be held on April 8th at the office of the liquidator, Mr. W. Honeyman Brown, 19a, Coleman Street, E.C. Particulars of claims to the liquidator by April 22nd. (This notice is purely formal; all creditors have been, or will be, paid in full.)

Hindhead and District Electric Light Co., Ltd.—A meeting of creditors is called for March 27th at the office of the liquidator, Mr. A. P. Ogden, Audrey House, Ely Place, E.C.1.

Epoch Electrical Society, Ltd.—Particulars of claims by April 5th to the liquidator, Mr. C. Hughes, 24 & 25, Ironmonger Lane, E.C.

Douglas Southern Electric Tramways, Ltd.—A meeting of members is called for April 15th at the offices of Messrs. E. Guthrie & Co., 71, King Street, Manchester, to hear an account of the winding up from the liquidator, Mr. G. A. Orme.

Metropolitan Electric Wire Co., Ltd.—Liquidator, Mr. E. T. A. Phillips, Carey Street, W.C., released March 7th.

Private Arrangements.

L. W. Westbury, trading as L. W. Westbury & Co., Lichfield Street, Walsall, wireless and electrical dealer.—A meeting of creditors was held recently. No statement of affairs was presented, but it was reported that the unsecured creditors' claims amounted to approximately £2,150. The assets consisted of stock in trade at cost £87. The debtor started business at Cannock four years ago, where he traded from his house. Subsequently he removed to Bloxwich, and two years later to the present premises at Walsall. A creditor had levied execution and the Sheriff had removed goods prior to selling them by auction. The debtor stated that his drawings had been between £4 and £5 a week. He said that during the past twelve months he had paid out about £500 to suing creditors and £164 by way of costs. During the early part of his trading he sold a retail shop, and the money obtained from that source was mainly used to pay the suing creditors. At the present time a number of writs and summonses had been issued and a creditor had obtained judgment. It appeared that the expenses on motors, wages, &c., had totalled about £15 a week. The debtor said that he did not become aware of his position until December last. It was resolved that provided the debtor found guarantors for the payment of a composition of 5s. in the £, payable as to 2s. 6d. in three months and 2s. 6d. in six months, the estate should be dealt with under a deed of assignment in favour of Mr. W. P. Barnfield, Walsall, as trustee.

Woodhead Bros., 31, Church Street, Rotherham, electrical engineers.—A meeting of creditors was held recently, when a statement of affairs was presented which disclosed liabilities of £2,570, of which £1,711 was due to the trade; there was a loan creditor amounting to £771, and the bank was a partly-secured creditor for £356, being unsecured for £88. The deficiency was £1,498. The business was commenced in July, 1923, with a capital of about £700. It was carried on successfully until about two years ago, when a branch was opened which did not prove successful, and was eventually closed down. Losses were made on various contracts, and on one estate a loss was shown of about £300. From April, 1927, to June 30th, 1928, a loss of £90 was sustained. The present deficiency was accounted for by the depreciation written off the various assets and the accumulated losses. It was resolved that a deed of assignment should be executed in favour of Mr. A. Arthur, Rotherham, as trustee, with a committee of inspection consisting of representatives of three of the creditors.

Reduction of Capital.

Erskine, Heap & Co., Ltd., and reduced.—A petition for the confirmation of the reduction of the capital of the company from £50,000 to £25,000 has been presented to the Court of Chancery of the County Palatine of Lancaster, and will be heard in Manchester on March 25th.

Deed of Arrangement.

R. E. A. Eaves and H. D. Cameron, trading as the Empress Radio and Electrical Co. at Manor Works, Stonehouse, Plymouth, and as the Westminster Radio at Plymouth, Bridgwater, Taunton and Newquay.—Particulars of claims by March 31st to the trustee, Mr. P. White, 6, Sussex Terrace, Princess Square, Plymouth.

Local Exhibitions.

Bradford-on-Avon.—An electrical exhibition organised by the Western Electricity Supply Co., Ltd., was held in the Town Hall on March 7th and 8th. It was officially opened by Mr. A. W. Edwards, J.P., who welcomed the enterprise of the company in providing facilities for the residents of Bradford to see some of the many uses of electricity in the home. Mr. A. J. Bridge, publicity and development manager, outlined the progress made during recent years in encouraging the use of electricity in the home. The exhibition, which was devoted chiefly to home lighting and small domestic appliances, was very well attended.

Ealing.—Ealing registered electrical contractors are to hold an electrical exhibition at the Ealing "Palladium," from April 6th to 13th inclusive; the Borough Council has agreed to give a free supply of electricity for the purposes of the display.

Preston.—The scope of the forthcoming electrical exhibition at Preston is to be larger than that of the previous event five years ago, and will embrace radio and commercial electricity, a feature being a model bakery. The Corporation's special exhibit will be model rooms in an average house demonstrating the application of electricity to domestic uses.

Agents in the Baltic States.

The British Consuls at Helsingfors and Kovno have furnished the Department of Overseas Trade with memoranda upon the appointment of agents in Finland and Lithuania. British firms interested in these markets can obtain copies of these memoranda upon application to the D.O.T., 35, Old Queen Street, S.W.1. (Reference 8790/2/28.)

The American G.E.C. in Portugal.

It is reported that a director of the American General Electric Co. is at present in Lisbon for the purpose of studying the project of electrifying the Portuguese railway system.

New Catalogues and Lists.

Messrs. G. A. Harvey & Co. (London), Ltd., Woolwich Road, S.E.7.—A profusely illustrated catalogue (No. 355) of ornamental metalwork, including examples of electric heater covers; also a leaflet containing particulars of the company's mild steel plates for the fixing of electric wires and cables.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Book I, Section 2b, illustrating and describing iron-cased signalling apparatus for mines, railways, industrial use, &c. Priced.

Kelvinator, Ltd., 258, Gray's Inn Road, W.C.1.—A booklet containing lists of users of "Kelvinator" refrigerators, with illustrations of actual installations of the equipment.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—A pamphlet—"The Lure of the Cotswold Hills"—describing, with illustrations, The Church Cottage, Witcombe, in which a Chloride battery has recently been installed.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—An amusing pamphlet, with illustrations by Riley, embodying a series of advertisements expounding the advantages of the company's "Cablegrip" service boxes.

Mr. Alan Wright, 124, Chancery Lane, W.C.2.—A booklet giving preliminary details of the 1929 "Inventum" water-heating programme, with particulars and prices of water heaters.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—Publication No. 8329, containing illustrations and details of the company's new ironclad isolating links for factories.

Messrs. Best & Lloyd, Ltd., Handsworth, Birmingham.—A priced catalogue of modern lighting fittings illustrating many examples of wall lights, table lamps, floor standards, pendants, &c., employing the company's "Firelight" glass.

Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—A circular letter advertising "Duplex-a-lite" units; and particulars of, and an agreement form for, the company's hire-purchase system.

Messrs. J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.—A folder (No. 1053), illustrating the economies in wiring effected by the use of individual light control. Details and prices of the company's ceiling switches are given.

The Walsall Hardware Manufacturing Co., Ltd., Hatherton Works, Ablewell Street, Walsall.—A pamphlet containing illustrations, particulars and prices of "Walsall" combined switch and fuse boards.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—March stock list of motors, dynamos, transformers, &c.

Mr. T. A. Rose, 25, Milton Street, E.C.2.—Two illustrated and priced pamphlets dealing with pocket, panel-mounting and switchboard instruments, and a portable miniature testing set.

Messrs. James Hendry, Ltd., 252, Main Street, Birmingham.—An illustrated brochure dealing with the manufacture and applications of the company's laminated leather belting.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—A brightly-coloured poster advertising the company's hire-purchase system in relation to its "Model 37" receiving set.

Setalite, Ltd., 1-4, Morley House, Regent Street, W.1.—Leaflets describing the "Setalite" universal voltage instrument for use on automobiles.

Messrs. Guy V. Laycock, Ltd., 12, Cloth Hall Street, Huddersfield.—Leaflet describing the "British" electric paper cutting or perforating machine.

B.T.H. Magnetos in Speed Test.

The British Thomson-Houston Co., Ltd., informs us that magnetos of its manufactare were fitted to the car in which Major H. O. D. Segrave attained a speed of 231.36 m.p.h. last week. B.T.H. magnetos also formed part of the equipment of the cars in which Capt. Malcolm Campbell and Major Segrave established earlier "records," while the motor-boat "Miss England," in which Major Segrave is attempting to set up a new water speed record is similarly equipped.

The "Electrical Review" in New Jersey.

British electrical visitors on their return from the U.S.A. sometimes tell us with satisfaction that they have found the familiar blue-covered Review available at certain points on their travels. It will interest some of our readers to know that every issue of the Electrical Review is fully indexed, by the Engineering Index Service, as soon as it is received, in a set of cards, which brings ready to hand any article on any subject in this journal and in any one of 1,700 other journals in all languages. This Engineering Index Service, instituted in January, 1928, is to be found in the Public Libraries of Newark, Cleveland, Bridgeport, Baltimore, and the John Crerar Library, Chicago. Engineers in any field who live or work in New Jersey, have access to this index to the latest engineering literature, in the Public Library of Newark, N.J., which has this journal on file.

Central Electricity Board.

In this issue the Central Electricity Board calls for tenders for the supply, delivery and erection of 33,000-V and lower voltage transformers in connection with the North-West England and North Wales Electricity Scheme, 1928.

New French Companies.

Among the companies recently formed in France are the Société de l'Union Coloniale d'Electricité, Paris (94, Rue de la Victoire), capital, 2½ million francs, to establish electricity supply undertakings in the French colonies; and the Compagnie Hydro-Electrique de la Cure, Paris (96, Rue de la Victoire), capital, 20,600,000 fr., to acquire and extend the undertakings of the Société des Chutes de la Cure et des Chemins de fer Electriques de l'Yonne.

Book Notices.

"Elektrisace Ceskoslovenska, 1918-1928" ("Electrification of Czecho-Slovakia, 1918-1928"). Pp. 177, 36 figs. and two maps. Prague: Elektrotechniky svaz Ceskoslovensky (Czecho-Slovak Electro-technical Union). Price 100 Czech crowns.—This volume has been published in connection with the tenth anniversary of the Republic to demonstrate what has been done in the electrification of the country since the War. In the first part of the volume, the originators of the systematic electrification express their views under the headings—Systematic electrification and its general importance, its promotion by means of a special law, its development in different parts of the country, comparison of the results obtained in Czecho-Slovakia during the ten years with those of foreign countries, electrification of country districts, of industry, of homes and of railways. Reports upon the activities of electricity producers' and distributors' organisations follow. The second part contains statistical data and descriptions of the most important plants. The public utility companies, who are charged with the task of carrying out the electrification programme, twenty-four in number, produced in 1922 90 million kWh, and in 1927 300 millions; their total investments in 1922 were 342 millions of Czecho-Slovak crowns and 1,347 millions in 1927. The 231 "non-utilities" produced in 1927 284 million kWh. The total length of distributing lines in 1926 was 18,000 km. The average consumption of electricity has risen from 71.5 kWh *per capita* in 1922 to about 140 kWh in 1928.

"Willing's Press Guide, 1929." Pp. xii+514. London: Willing Service (Willing & Co., Ltd.). Price 2s. 6d.—The 1929 issue of this useful handbook is the second of the new series and the fifty-sixth annual issue. The volume contains several new features, such as the introduction of indicative initials at the head of each page. Net sales or guaranteed circulation figures have been added where this information has been furnished by the different newspapers and periodical Press. All the remaining features have been carefully checked and brought up to date. The book contains much information useful to those who use the Press for advertising purposes.

"Nickel Steels." Pp. 36; figs. 28. London: Mond Nickel Co., Ltd.—A publication of the research and development department of the company, which deals with the mechanical properties of nickel steels and the effects of composition and heat treatment.

"Practical Geometry and Engineering Graphics." By W. Abbott. Pp. 304; figs. 343. London: Blackie & Son, Ltd. Price 10s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVII. March, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

For Sale.

By order of the liquidator, Messrs. H. Butcher & Co. will sell by auction on April 16th, on the premises, Station Road, Maldon, Essex, the freehold factory, plant and machinery of the Maldon Electrical Works. Weston-super-Mare District Council invites offers for 3,000 ft. of h.d. copper wire cable. The Burgh of Hamilton Electricity Department has for disposal one 620-Ah Tudor battery. Falkirk Borough Electricity Department invites offers for one 250-kW Westinghouse rotary convertor with starter and switchgear. Worcester Corporation Electricity Department has for disposal several motor-generators and a 2-ton electric motor hoist. The West Central Merchandise Mart will sell by auction on March 27th, at York House, Southampton Row, W.C., a stock of cables, electrical fittings and wireless goods. Great Yarmouth Corporation Electricity Department invites offers for 20,000 used electric lamps of various sizes, all 100 V. Greenock Corporation Electricity Department has for disposal surplus generating plant, &c. (See our advertisement pages to-day.)

Unemployment.

There was a fall of 4,560 in the number of registered unemployed during the week ended March 4th. At that date the total was 1,387,300, as compared with 1,391,860 on February 25th, and 1,094,452 on March 5th, 1928.

Social Events.

The first annual dinner of the staff of the London Power Co., Ltd., was held at the Connaught Rooms on March 8th, the chairman of the company, Mr. W. F. Fladgate, M.V.O., presiding, supported by Mr. W. A. Pearman (general manager) and Dr. S. L. Pearce (engineer-in-chief). There was an attendance of over 200. After the loyal toast, Dr. Pearce, proposing the health of the chairman, drew attention to the prominent part which Mr. Fladgate had taken in securing the co-ordination of electricity supply in London. In acknowledging the toast, Mr. Fladgate said that his connection with

electricity dated from the time when, as a boy, in 1863, he heard Tyndall lecture on electricity at the Royal Institution. Since that time a great deal had happened in the electrical world. There was still much to be done, and he looked forward to a continuance of the good feeling which existed between all sections of the company. The health of the general manager and the engineer-in-chief was proposed by Mr. Mackenzie, and briefly responded to. A musical and comedy entertainment followed the dinner.

The sixth annual staff dinner of the Automatic Telephone Manufacturing Co., Ltd., was held on March 8th at the Exchange Hotel, Liverpool. Sir Alexander Roger (chairman) presided over a company of about 170, and was supported by Mr. G. W. Moore (director and manager). The toast of "The Company" was proposed by Mr. C. Hitchen and responded to by the chairman, whilst the guests were toasted by Mr. G R. Maitland, Mr. E. A. Ward responding. Other speakers during the evening were Mr. H. E. Powell-Jones, Telephone Development Association, and Mr. G. W. Moore. The dinner was followed by an entertainment provided by the "Duds" concert party, under the direction of Mr. Ralph Collis.

Henley's Dramatic Club is producing "The Whole Town's Talking," a farce in three acts, at the Cripplegate Theatre, Golden Lane, London, E.C.1, on March 23rd, at 7.30 p.m. Tickets are obtainable at from 2s. to 5s., from Mr. W. G. Turner, 11, Holborn Viaduct, E.C.1.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Mar 19.	Fortnight's inc or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£62	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb,	8½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	8d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	8¾d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£204	£4 inc.
	Grade II ... ... ,, ,,	£142	£3 inc.
	Grade III ... ... ,, ,,	£79	£4 inc.
c	Brass (rolled metal 9" to 12" basis) per lb.	11¼d.	¼d. inc.
c	,, Tubes (solid drawn) ... ... ,,	1/2 to 1/2¾d.	¾d. to 1d. inc.
c	,, Wire, basis ... ... ,,	1/0½	¼d. inc.
c	Copper Tubes (solid drawn) ... ,,	1/4½	1d. inc.
c	,, Bars (best selected) ... per ton.	£125	£9 inc.
c	,, Sheet ... ... ,,	£125	£9 inc.
c	,, Rod ... ... ,,	£125	£9 inc.
d	,, (Electrolytic) Bars ... ,,	£125	£9 inc.
d	,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£109 10s.	£8 inc.
d	,, ,, H.C. Wire per lb.	1/1¾	¼d. inc.
f	Ebonite Rod ... ... ,,	2/3 to 2/8	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
g	German Silver Wire ... ... ,,	2/3	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India rubber, Para fine ... ... ,,	1/1½	¼d. dec.
i	Iron Pig (Cleveland No. 8.) ... per ton.	67/-	3/- dec.
i	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£29	£1 inc.
g	Mercury ... ... per bot.	£22 2s 6d. to £22 5s.	...
e	Mica (in original cases) small ... per lb.	8d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/9½	...
p	,, ,, drawn bars & rods ,,	1/5	1¼d. inc.
p	,, ,, rolled strip & sheet ,,	1/4½	¾d. inc.
p	,, ,, wire... ... ... ,,	1/6½	¾d. inc.
o	Platinum ... ... per oz.	£13 17s. 6d.	...
d	Silicium Bronze Wire ... ... per lb.	1/1	...
r	Steel, Magnet. in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton.	£224 10s. to £225 10s.	£5 to £5 10s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In their letter dated March 16th, Messrs. James Forster and Co. stated that a setback during the week was followed by a recovery and, assisted by further speculative buying, lead prices rose 15s. per ton, the tone at the close being firm. There were speculative orders from America, based presumably on the strength of the continuation of the Mexican revolution. At present shipments of lead from that quarter are being held up, but regular shipments are expected to be resumed shortly. Demand in this country remains quiet; supplies are ample and higher prices than the present are not justified. However, speculation may drive prices higher yet.

Proposed South African Duty Reductions.

In introducing the Budget for the year, Mr. Havenga, the South African Minister of Finance, announced that it was proposed to reduce the Customs duties on several classes of goods of a kind not made in South Africa. Among them was included certain electrical apparatus.

Trade Announcements.

Mr. C. McKinlay has resigned his position with Metro-Vick Supplies, Ltd., and has been appointed sales representative in England, Wales and Ireland for Messrs. Lane and Girvan, Ltd., Bonnybridge, near Glasgow, who have just completed a new works for the production of "Caledonia" electric cooking and heating apparatus. Mr. Douglas Arthur, who for some years has been associated with the Falkirk Iron Co., Ltd., has been appointed in a similar capacity for Scotland.

"K.N." Electrical Products, Ltd., has removed to larger premises at 5, 6 & 7, Singer Street, Tabernacle Street, E.C.2. (Telephone: Clerkenwell 6643; telegrams "Kayenelec, Finsquare.")

The telephone number of Hooper's Telegraph & India Rubber Works, Ltd., Adelaide House, King William Street, E.C.4, has been altered to "Mansion House 6626."

The registered offices of the Lorival Manufacturing Co. (1921), Ltd., have been transferred to the company's Norwood Works, Southall, Middlesex.

The Corlett Electrical Engineering Co., Ltd., has removed to 85, Wallgate, Wigan.

The address of the Piggott Electrical Co., Ltd., is now Salisbury Square House (Dorset Street entrance), Fleet Street, E.C.4. The telephone number (City 1014) is unchanged.

The offices of Francis Lamp Locks, Ltd., have been removed to 2, 3 and 4, Cockspur Street, S.W.1. (Telephone: Regent 1227 and 1228; telegrams: "Lamlok, London.")

Commercial Electrical Travellers.

The Electrical Trades' Commercial Travellers' Association is holding a whist drive this evening (Friday) at the British Commercial Travellers' Club, 24, New Oxford Street, W.C.1.

Lighting and Power Notes.

Argentina.—Electrical Development.—According to a return recently prepared by the Argentine Electrotechnical Association there were 1,266 power stations, with a total capacity of 305,348 h.p., in operation in the Argentine at the end of 1927. The total was made up of 226 steam-operated stations (140,470 h.p.), 979 plants operated by internal combustion engines (125,240 h.p.), and 61 hydro-electric power stations (39,648 h.p.).

Ashford (Kent).—Loans.—The Urban District Council has applied for sanction to a loan of £2,000 for supplying electricity to Wye, and £9,000 for extensions to the plant at the electricity works.

Barnsley.—Mains Extensions.—The Corporation Electricity Committee has received sanction to a loan of £2,322 for mains extensions.

Birmingham.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to the following loans: buildings (sub-station), £51,700; consumers' sub-station equipment, £198,100; frequency-changer, £11,500; purchase of Imperial Arcade, Dale End, £30,000.

Blackpool.—Loans.—The Corporation has received sanction to the borrowing of the following loans for additional h.p. transmission lines from Preston to Blackpool:—Underground mains, £13,000; overhead lines, £6,500; plant (transformers and switchgear), £20,500.

Canada.—Hydro-Electric Development.—The Premier of Ontario recently announced in the Provincial Legislature that additional development of power would be undertaken by the Hydro-Electric Power Commission of Ontario to supply the northern section of the Province, in addition to the increased requirements of the section already supplied. The project will include a transmission line running north from Toronto, to tap new power sources with a total capacity of approximately 500,000 h.p. These sources of supply include the Nipigon, power reserve, the Mississauga reserve, power sites on the Ottawa River, prospective development on the Abitibi Canyon, and the Wahnipitae system of Sudbury. This huge development, it is proposed, will centre around the Wahnipitae system, which is within comparatively easy reach of the Ottawa and Western power reserves, and can easily be linked in with them.

Continental.—Germany.—An official return recently issued shows that the output of the 127 principal power stations in Germany during the first eleven months of last year amounted to approximately 12,974 million kWh, as compared with 11,110 million kWh in the corresponding period of 1927.

Belgium.—The Société des Charbonnages de Ressaix, Leval, Peronnes, Ste. Aldegonde and Genck, which has recently formed a subsidiary concern for the manufacture of synthetic ammonia, has decided to erect a new steam-operated power station with a capacity of 30,000 kW to supply the necessary power for the new undertaking. The boilers at the new power station will be adapted for pulverised fuel firing.

Colchester.—Loans.—The Town Council is making application for sanction to the borrowing of £7,500 for cookers, wiring and fittings, and £7,500 for prepayment meters and wiring.

Consulting Engineer.—In connection with the proposed extensions to the power station, the Council has decided to retain the services of Mr. W. C. C. Hawtayne as consulting engineer.

Dewsbury.—Electricity Supply.—The Town Council has decided to carry out a scheme for the supply of electricity to the new General Infirmary and adjoining area at an estimated cost, including the necessary sub-stations, of £7,164.

Dumfries.—Loan.—The Corporation Finance Committee is to apply for sanction to a loan of £10,000 to meet the cost of extensions, &c., at the electricity works.

Eastbourne.—Loans.—The Corporation Electricity Committee is applying for sanction to the borrowing of £15,408 for provision of mains, &c., Sanction has been received to a loan of £2,793 for mains and services in connection with the supply of electricity to Attfield Estate, Hampden Park.

Exmouth.—Transfer of Undertaking.—The Urban District Council is to instruct Parliamentary agents to lodge an objection to the draft Order for which the Electric Supply Corporation, Ltd., is applying to the Electricity Commissioners. The Order will authorise the transfer of the electricity undertaking to another company.

Glasgow.—Administration.—The Corporation Electricity Committee on March 15th approved a report submitted by Mr. H. Bell, general manager, dealing with his preliminary investigation of the administration, operation, and general efficiency of the Electricity Department. Mr. Bell stated that it was estimated that the saving in revenue expenditure in respect of wages, material, debt charges, and rates and charges as compared with the previous year, would, due to various causes, amount to £40,000. It was further estimated that there would be a reduction in capital expenditure in respect of wages amounting to £31,000 and of materials amounting to £149,000. Pointing out that the sales of the Department over the past five years had increased from 142 million kWh to 220 millions, he stated that it would be apparent that any development of business could only be accomplished by a materially enlarged and improved sales organisation. The principal proposal contained in the report was the appointment of a sales manager competent to co-operate with the existing technical staff. During the present financial year considerable curtailment of activities at the premises at Port Dundas had taken place. Of 31 transport vehicles, eight were redundant and taken off the road. During the past year the Department had reduced the number of employés by over 300. The clerical staff had been reduced during the last three years by nearly 10 per cent., but no further material reductions could take place without loss of efficiency.

Gravesend.—Loan.—The Corporation Electricity Committee is applying for sanction to borrow £3,165 for the provision of eight 200-kVA transformers, five kiosks and e.h.p. switchgear.

Guisborough.—Loan.—The Urban District Council has applied for sanction to a loan of £1,000 for meters.

Hastings.—Overhead Lines.—The Corporation Electricity Committee has received sanction to the borrowing of £1,865 for the erection of overhead lines in Battle.

Heston and Isleworth.—Street Lighting.—The Electricity Department of the Urban District Council proposes carrying out street lighting improvements in Hounslow High Street and London Road by the provision of 1,000-c.p. lamps, at an estimated cost of £4,612, for which sanction is to be sought.

Isle of Wight.—Change-Over.—At a meeting of the Newport Corporation, the town clerk submitted a letter from the chairman of the Isle of Wight Electric Light and Power Co., Ltd., as to the suggested change in the system of electricity supply in the island from d.c. to a.c., in which the company stated that if this was agreed to it would mean a new Special Order for the whole island to replace existing Orders, of which there were 10 in force. If the local authorities of the island were willing to co-operate with the company to obtain such an Order the company was willing to put into force reductions in the charges for electricity. The town clerk reported that at a conference of local authorities to consider the company's proposals the matter was deferred in order that further information might be obtained.

Irish Free State.—Manorhamilton (Co. Leitrim).—The power station in the town was destroyed by fire on the night of March 9th, the damage being estimated at £2,000. There was no water supply available, and no attempt could be made to save the concern.

Lathom and Burscough (Lancs.).—Electricity Supply.—The Urban District Council has asked Mr. James Scott, electrical engineer of Bootle, to furnish a report to the Council on the advisability of applying for an Order authorising the Council to supply electricity in the district.

Lewes.—Street Lighting.—The Town Council has adopted a scheme for extending the public lighting by electricity under a ten years' contract with the Lewes and District Electric Supply Co., Ltd. Under the new arrangement the consumption will be increased from 64,000 to approximately 125,000 kWh per annum, and the company will bear the whole capital cost, together with the maintenance and renewal of all lamps and fittings. The charges per lamp are to be reviewed at the end of every third year.

Lincoln.—Loans.—The Town Council has applied for sanction to loans of £10,000 for cables, and £4,750 for switchgear.

London.—Islington.—The Borough Council Finance Committee is seeking sanction to borrow £80,000 for mains, services, meters, transformers, time switches, &c.

Hackney.—The Electricity Committee has recommended that Messrs. May & Hawes be appointed consulting engineers in connection with the proposed extension of the power station as a "selected" station under the South-East England Electricity Scheme, 1927, at a fee of 1 per cent. upon the capital expenditure on plant, subject to a maximum of £3,500.

Manchester.—Progress During December.—During the month of December the Corporation electricity undertaking showed an increase in connections of 2,539 kW, bringing the total up to 370,202 kW; and the number of applications received for supply, including those for additional supplies, was 1,152, representing a total of 2,309 kW. The number of hired cookers connected increased by 78, bringing the total actually on circuit to 5,025. Applications for the hire of cookers totalled 56. The maximum load recorded reached 156,370 on December 17th, a record for the undertaking. One new sub-station was put into commission, and additional plant installed at three existing sub-stations. The change-over from d.c. to a.c. has been completed in the cases of 3,679 consumers, work is in progress involving 533 consumers, and sanction has been received in respect of an additional 632 consumers.

Newark.—Electricity Accounts Estimates.—The estimates of the electricity undertaking which were recently submitted to the Town Council show a satisfactory financial position. The scheme was inaugurated just over two years ago, the Council entering into an agreement with the Derbyshire and Nottinghamshire Electric Power Co. for a supply in bulk, the minimum guarantee to the company for the year being £5,000. The actual payment was £5,284, with an additional £1,000 for a supply to the Corporation's waterworks at Farnsfield. The accounts for the twelve months show a gross profit of £4,757, of which interest on loans absorbs £1,532, sinking fund instalment, £1,027, deficiency of the previous two years £700, leaving a balance of £1,494. There has been an increase in sales of nearly two million kWh on the previous year.

Paisley.—Electricity in Bulk.—The question of taking all the electricity required under the bulk supply agreement and shutting down the station at Blackhall was considered recently by the Corporation Electricity Sub-Committee. It was agreed to recommend that, owing to irregularity in the supply, it would be inadvisable at present to close down the station.

Portsmouth.—Street Lighting.—The Corporation Electricity Committee has decided to reduce the charges for the erection of small street lamps, at present £6 13s. 6d., and for the conversion of gas lamps, at present £3 15s. 6d., to £3 3s. in both cases.

Loan.—Application is to be made for sanction to the borrowing of £9,500 for the provision of 0.15 sq. in. e.h.p. 66,000-V mains in the city from the generating station to sub-stations at Dover Road, Fawcett Road, Lower Forbury Road, Fratton Grove, and Terwick Street.

Assisted Wiring Scheme.—On the recommendation of the Committee, the City Council has adopted a scheme for the electrical wiring of private dwelling houses in the city upon the hire-purchase principle. The scheme does not apply to houses in the course of erection. Ten per cent. of the cost must be paid by the consumer to the Corporation upon his signing the agreement to have the work carried out, the balance of 90 per cent. being met by equal quarterly payments over a period of five years.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Whitby.—Commercial baking ovens and restaurant cooking: From 1½d. to 1d. per kWh.

Dover.—Lighting: From 6½d. to 5½d. per kWh, with a discount of ½d. per kWh for prompt payment of accounts.

Wallasey.—Lighting: From 4½d. to 3½d.

Elgin.—*The Elgin Electric Supply Co., Ltd.*—Lighting: From 1s. to 10d. per kWh.

The Lothians Electric Power Co., Ltd.—Consumers supplied on the contract system: From 1½d. to 1d. per kWh.

Hackney.—Private lighting and domestic uses:—Scale "A," alternative No. 1, from 1d. to ¾d. per kWh; scale "D," from 1d. to ¾d. per kWh; scale "C," from 1d. to ¾d. per kWh; scale "F," from 6/10d. to ¼d. per kWh. Power and factory lighting:—Scale "D," alternative No. 1, from ¾d. to ½d. per kWh.

Ripon.—Supply Extension.—The City Council is applying for sanction to borrow £1,170 for an extension of the electricity supply to Wormald Green, and a further sum of £3,875 for work in connection with the construction of an overhead transmission line from a point near Burton Leonard to Ripon. The electricity supply for Ripon is expected to be available in the early summer, and the charges will be 6d. per kWh for lighting, and 2d. per kWh for power.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Holderness Trust, Ltd., to supply electricity in the urban district of Withernsea and part of the rural district of Patrington; the Culm Valley Electric Supply Co., Ltd., to supply in the rural district of Culmstock and part of the rural district of Tiverton; and the Yorkshire Electric Power Co., to supply in parts of the rural districts of Chapel-en-le-Frith and Bakewell.

The Minister of Transport has confirmed a Special Order made by the Commissioners authorising the Braunton Electric Light and Power Co., Ltd., to supply electricity in part of the rural district of Barnstaple.

St. Helens.—Loan Sanctioned.—The Town Council has received sanction to a loan of £2,950 in connection with the supply of electricity to the Blackbrook housing estate.

Torpoint.—Opposition to Application.—The Urban District Council has resolved to oppose the Torpoint Electricity Supply Company's application for powers to supply electricity in the district. It was mentioned at a recent meeting that the Saltash Town Council and the St. Germans Rural District Council had approved the company's application.

Wellington (Salop).—Electricity Supply.—At a recent meeting of the Urban District Council the clerk stated that he had been interviewed by representatives of a firm which had acquired rights to provide electricity in twelve districts from Exmouth to Minehead. It was expected that the matter would be through Parliament in about three months, and that within eight months standards would be erected in Wellington. The price would be about 9d. per kWh for lighting and 2½d. per kWh for power.

Winchester.—Cable Extensions.—The Town Council has decided to carry out cable extensions for improving the supply to the lower end of High Street and to St. Giles' Hill and surrounding district, at an estimated cost of £4,865.

Worthing.—Loans.—The Town Council has applied for sanction to loans totalling £31,665 for the following purposes: Convertor plant and switchgear to deal with the bulk supply from Southwick, £8,832; cables for the supply of electricity to Findon, and overhead extensions from Findon to Muntham Court, £1,050; feeder cables, £4,680; alterations and additions to boiler house, £6,240; motor generator for feeder regulation, £525; d.c. balancing transformer, £430; new sub-station, £550.

Tramway and Railway Notes.

Birmingham.—New Cars.—The Corporation Tramways Committee has obtained sanction to a loan of £125,000 for the purchase of 50 new tramcars.

Continental.—Italy.—A new funicular railway has recently been inaugurated, which connects the centre of Naples with the hill of du Vomero and is 1,230 m. in length. Each of the two trains weigh 14 tons empty and are capable of transporting 100 passengers. The normal power is 240 h.p.

To improve the transportation facilities in Genoa it is proposed to construct an electric funicular railway between Borgoratti and Apparizone, which will have an average gradient of 22 per cent. and a total length of 4,500 m. The cars will be fitted with hand and electric brakes and each will accommodate 44 passengers.

London. — Loud-Speakers on Platforms. — Experiments have proved successful with loud-speakers to impart information regarding incoming trains at London Bridge station of the Southern Railway, and it has been decided to make them a permanent part of the organisation for handling the homeward rush-hour traffic.

Children's Fares.—The issue of 6d. daily tickets for children last year having proved satisfactory, the Highways Committee has recommended that the scheme be continued during the period April 1st to September 30th next.

Mexborough.—Railless Cars.—A new railless-car service between Maltby, Rotherham and Conisborough was recently inaugurated. The new service is intended to improve travelling facilities over the original route of the Mexborough and Swinton Tramways Co., plus an extension to Conisborough.

Plymouth.—Transport Improvements.—It was stated at the March meeting of the City Council by the chairman of the Tramways and Transport Committee that the work of building new omnibus bodies and new tramcars, together with a heavy programme of permanent-way reconstruction, had now been completed. The Committee had resolved to purchase twelve omnibuses of the single-deck type to meet the requirements due to the normal growth of the undertaking and for the replacement of the rolling stock, at a price of £1,466 per 'bus, and application is being made to the Ministry of Transport for sanction to borrow £18,000 for the purchase.

United States.—New York.—The Bronx Concourse subway extension in New York City, which will join the Manhattan Line at 148th Street and St. Nicholas Avenue, is progressing along St. Nicholas Place toward the vicinity of the Polo Grounds, where it will cross under the Harlem River and pass the Yankee Stadium, continuing on up under the concourse. According to the *Electric Railway Journal*, five contracts on the Bronx line have been awarded as far as Kingsbridge Road, amounting to approximately $28,000,000. The balance of the concourse line will be under contract during the present year, according to the authorities. Mayor Walker, of New York City, states that plans for the consummation of the entire programme of the rapid transit development, involving an expenditure of $700,000,000, are being anticipated. It is expected to advance the work this year by at least $100,000,000 and that the end of 1929 will bring a solution of practically all the problems involved in this undertaking.

Warwick.—Parliamentary Bill.—*The Times* reports that the Local Legislation Committee, which has been considering the Bill promoted by the Leamington and Warwick Electrical Co., Ltd., to authorise it to run railless cars in the two boroughs in which it is at present operating a tramway service gave its decision on March 14th. Mr. Wrottesley, K.C., for the promoters, said that his clients and the public bodies opposing the Bill—the Warwick and Leamington Corporations and the Warwickshire County Council—had agreed to a settlement as follows: (1) The promoters were to take up their tram way in a manner approved by the Corporations and to make a contribution in respect of restoring the highways. (2) The promoters agreed to abandon the clauses of the Bill seeking power to run railless cars and to run omnibus services. (3) The promoters had agreed to charge 1d. per mile fare instead of the 1½d. charged as the normal maximum fare all over the country. (4) In return, the Corporations were to give protection against competition to the promoters' omnibus service. The chairman announced that the Committee held that the preamble had been proved subject to the conditions agreed to between the promoters and the local authorities. The promoting company would be protected and have absolute running powers for omnibuses, not only over its present tramway route but over all the routes specified in the Bill.

Telegraph and Telephone Notes.

Australia.—Radio Tariffs.—The Melbourne correspondent of *The Times* reports that Rear-Admiral W. R. Napier, of the Australian Naval Board, giving evidence at the Senate inquiry into whether wireless charges should be reduced to a penny a word, said the beam system was unable to carry single-handed the traffic between England and Australia. He advocated the maintenance of the cable system, which offered means of secret communication and also a 24 hours' service. The nation commanding the sea, he observed, also guaranteed cable communication.

Telephone Tariff.—On an average subscribers in the capital cities of the Commonwealth make approximately 1,400 telephone calls each year. Using this figure as a basis, the annual cost in respect of a telephone service is as follows: Australia, £12 5s. 10d.; Great Britain, £13 16s. 8d.; New Zealand, £15; United States, £17 1s. 8d.; Canada, £17 10s. A country subscriber makes approximately 500 calls a year, and the comparative figures are as follow: Australia, £5 1s. 8d.; Canada, £5 12s. 6d.; New Zealand, £6; United States, £7; Great Britain, £7 11s. 8d. Evening and trunk-line tariffs are even more generous to the Australian subscriber.

South America.—Automatic Telephony.—The municipality and the telephone company have agreed on the installation of automatic telephones in the whole of the Rio de Janeiro Federal district in twenty-four months. The Light and Power Co., according to the *Financial News*, will employ £1,000,000 worth of material.

Sweden.—Submarine Telephone Cable.—The laying of what is claimed to be the longest submarine telephone cable in the world between Sweden and Finland, connecting Stockholm with Aabo, has just been completed. The cable distance is 242 kilometres, of which 212 kilometres' length is marine cable, the total weight being 2,000 tons. The thickness of the cable is 45 mm. on the Swedish side and 50 mm. on the Finnish side. It contains 32 copper wires, made up together four and four into eight four-wire conductors; seven of them are intended for an equal number of calls on the four-wire principle between Sweden and Finland, the eighth trunk permitting two calls on the two-wire principle between Aaland and the mainlands of Finland and Sweden.

The Telegraph Service.—COMMISSION OF INQUIRY.—The Commission of Inquiry which was appointed by the British Post Office authorities last year to visit the U.S.A. and investigate the organisation and methods of working of the American telegraph companies has reported to the Postmaster-General. Its report includes recommendations relative to apparatus, the recruitment and training of staff, control, and various proposals for popularising the inland telegraph service.

United States.—TELEGRAPH CABLE MERGER RUMOURS.—Mr. Newcom B. Carlton, president of the Western Union Telegraph Co., stated on his return from Europe on March 12th that a communications merger between the Radio Corporation of America (which works in conjunction with the Marconi European services) and the Western Union Co. was still under discussion; no definite decision, however, was in sight. Mr. Carlton went abroad in order to observe the results of the British cable merger, which, he said, would have "a decided effect upon the activities of American companies." He explained that he had discussed a tentative *modus operandi* between British and American cable companies, but that no final agreement was reached. A combination of the Western Union Co. and the Radio Corporation of America would form one of the most extensive communication systems of the world. Recently negotiations were reported to have been postponed owing to fear that such a deal might violate the provisions of the American White Law, which is designed to prevent mergers calculated to diminish competition.—*Reuter's* (New York).

NEW RADIO COMPANY.—The Radio Corporation of America announces the formation of a new subsidiary company called "Radio Corporation of America Communications, Incorporated," which will take over its communication business, except that of the ship-to-shore service. The announcement follows the recent negotiations between the R.C.A., the Western Union, and the Postal Telegraph Co., which have evidently terminated, since the new company is wholly owned by the R.C.A., and will be a direct competitor against the other two. General Harbord has been elected president of the subsidiary company, which will develop independently of the manufacturing and sales interests of the Radio Corporation of America.

Radio Notes.

Common Wavelength.—DUNDEE.—The Dundee station has been included among those stations transmitting on the national common wavelength of 288.5 metres (1,040 kilohertz), which is ultimately to be adopted by practically all British relay stations. The change took place on March 16th; as the station formerly transmitted on a frequency of 1,020 kilohertz (294.1 metres), the change is so slight that very little, if any, readjustment of listeners' receiving apparatus should have been necessary.

France.—RADIO BILL.—The Bill which is shortly to come before the French Parliment, defining the rights and conditions of broadcasting, will raise the question of the censorship of programmes. Two suggestions will be put forward, one emanating from Mr. Francois-Poncet before he was appointed Under Secretary of State for Fine Arts, and the other from the Government. Objection is being taken to the Government's proposal, which would delay by three hours most news.—*Reuter* (Paris).

United States.—LAW TEST CASE.—The Court of Appeals of the District of Columbia has delivered a judgment which is likely to cause the Federal Radio Commission serious embarrassment in future. Station WGY (Schenectady), operated by the General Electric Co., took legal action against the Commission when it refused to renew the station's broadcasting licence on a full-time basis. The Commission was obliged, by the equalising requirement of the Davis amendment to the Radio Act, to curtail the time allotted to one or other of the powerful stations operating in Columbia, says *World Radio*, and the appellate court which heard the appeal ruled that curtailment of the Schenectady station's time was not justified.

This is the first decision of the kind made by an appellate court designated in the Radio Act to settle disputes. Its importance is the fact that henceforth the ruling of the Radio Commission on any station's comparative utility is legally open to serious challenge, and unless it appeals successfully to the Supreme Court of the United States against the judgment it is likely that other stations will begin legal action against its rulings.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—May 15th. Victorian Railways. One geared 3-phase electric winding engine. (A.X. 7650.)*

MELBOURNE.—Victorian Railway Commissioners. April 5th. Rectifiers and storage batteries for power signalling. (B.X. 5166.)* Dwarf electric signal mechanisms. (B.X. 5168.)*

Blackpool.—March 27th. Town Council. Two electrically-driven sewage pumps. Specifications from F. Wood, borough engineer, Municipal Buildings, Town Hall Street.

China.—SHANGHAI.—March 30th. Kailan Mining Administration. Two 300-kW turbo-generator sets. (B.X. 5174.)*

East Ham.—March 23rd. Electricity and Tramways Department. 5,750 yd. e.h.p. cable. (March 15th.)

Edinburgh.—March 25th. Electricity Supply Committee. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuseboards, electricity supply meters. (February 15th.)

Edlington.—April 17th. West Riding Education Committee. Installation of electric lighting at new schools and caretaker's house. Education Officer, County Hall, Wakefield.

Farnworth.—April 3rd. Electricity Department. L.p. cables. (March 22nd.)

Gloucester.—March 25th. Electricity Department. Two 1,000-kW motor-generators. (March 8th.)

Harrogate.—March 23rd. Electricity Department. Cables, joint boxes, joint box compound, service meters, cut-outs and transformers for 12 months. (March 8th.)

Ilford.—March 25th. Electricity Department. Supply of paper-insulated cables. (March 8th.)

India.—NEW DELHI.—Indian Stores Department. March 26th. Oil engine generator set. (B.X. 5157.)*

Knottingley.—March 25th. Urban District Council. Wiring 48 houses in Weeland Road, and Womersley Road. Forms of tender from the Council's Surveyor, Town Hall.

London.—CENTRAL ELECTRICITY BOARD.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (March 15th.)

March 25th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V and lower voltage transformers. (See this issue.)

BETHNAL GREEN.—March 25th. Borough Council. Electric lighting installation at seven blocks of tenement buildings in Bethnal Green. (March 8th.)

ISLINGTON.—March 26th. Cleansing Committee. One new lead battery for Edison vehicle. (March 15th.)

PADDINGTON.—April 8th. Great Western Railway. Stores, including electrical wires and cables, telegraph ironwork, and iron and steel wires. (See this issue.)

Manchester.—April 3rd. Electricity Committee. One 8,000-kVA air-cooled transformer. (March 15th.)

April 8th. Two 33,000-V metal-clad switch units. (See this issue.)

March 25th. Corporation. Heavy a.c. equipment, cables and lighting installation at tramway works extensions. City Architect, Town Hall. Deposit £1 1s.

New Zealand.—WELLINGTON.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Oldham.—March 27th. Housing Committee. Electric lighting installation for 200 houses on the Corporation housing estate. Borough Engineer, Town Hall.

South Africa.—PORT ELIZABETH.—March 28th. Municipal Council. 33,000-V cable, transformers, disconnecting boxes, oil switches, link switches, trifurcating boxes, and electricity meters. (B.X. 5146-7-8.)*

UMTALI.—April 18th. Municipal Council. 1,000-kW turbo-alternator, spray cooling plant, switchgear, transformers, crane, &c. (B.X. 5142-5.)*

JOHANNESBURG.—April 25th. South African Railways and Harbours. Three electrically-driven wheel lathes. (A.X. 7621.)*

May 16th. Electric signalling apparatus. (B.X. 5165.)*

Stirling.—March 25th. Corporation. Electrical work in connection with 10 houses. Specifications from burgh surveyor.

Wolverhampton.—April 5th. West Midlands Joint Electricity Authority. Three single-phase, 4,000-kVA transformers. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Ashford (Kent).—Urban Council. Accepted :—
Eight-cylinder engine, with supercharger and alternator, for the electricity works (£7,798).—Davey, Paxman and Co., Ltd.

Bedwas and Machen.—Urban Council. Accepted :—
Overhead lines, &c., in connection with extensions to Maesycwmmer, Bedwas, and Machen.—W. T. Henley's Telegraph Works Co., Ltd.

Brentwood.—Correction.—In the list of tenders for the internal wiring at Brentwood Mental Asylum (Elec. Rev., March 15th, p. 478), the amount of the tender of Read and Partners, Ltd., of Westminster, was incorrectly given as £9,240. The actual quotation of this company was £11,240.

Carlisle.—Town Council. Accepted :—
Installing electric light in Council houses.—A. G. Bullen and Co., and W. Batey & Sons.

Dewsbury.—Town Council. Accepted :—
L.p. cable (£1,000).—Power and Lighting Cables, Ltd.
E.h.p. cable (£1,495).—W. T. Henley's Telegraph Works Co., Ltd.
H.p. switchgear (£1,143).—Ferguson, Pailin, Ltd.

Doncaster.—Town Council. Accepted :—
Installing electric light at the new Infectious Diseases Hospital (£1,707).—W. Skewes, Ltd.

Douglas (I.O.M.).—Electricity Committee. Accepted :—
L.p. board for Pulrose and h.p. panels for Summer Hill sub-station (£339).—New Switchgear Construction Co., Ltd.
Wiring 100 houses on Pulrose Estate (£656).—Siemens Bros. & Co., Ltd.

Dumfries.—Town Council. Accepted :—
Installing electric light in 36 houses, at £18 9s. 4d. per block.—Gordon & Moodycliffe.

Ealing.—Borough Council. Accepted :—
Electrical sewage pumping machinery at Northern sewage works (£440).—R. E. Smart & Co.

Glasgow.—Tramways Committee. Recommended :—
2,000 tons of steel rails (£19,700).—Bolckow, Vaughan and Co., Ltd.

Gravesend.—Electricity Committee. Recommended :—
Transformer (£136).—Bruce Peebles & Co., Ltd.
Switchgear (£234).—British Thomson-Houston Co., Ltd.

London.—St. Pancras.—Contracts and Stores Committee. Recommended :—
L.p. cable for stand-by supply to the *Daily Sketch* and *Sunday Graphic* premises (£6,315).—Hackbridge Cable Co., Ltd.
One kiosk-type sub-station (£388).—Electric Construction Co., Ltd. (Recommended.)

Islington.—Electricity Committee. Recommended :—
Scott-connected transformers of either 750 kVA, and/or 1,500 kVA capacity up to a maximum of 9,000 kVA, for sub-stations as and when required up to December 31st, 1931 :—

	Price per unit. 750 kVA.	1,500 kVA.
C. Dikkers, Ltd. (made in Holland) ...	£370	£572
Hackbridge Electric Construction Co., Ltd. (Recommended.)	379	625
Foster Engineering Co., Ltd.	446	683
Yorkshire Electric Transformer Co. ...	478	666
C. A. Parsons & Co., Ltd.	540	730
A.S.E.A. Electric, Ltd.	545	850
Brush Electrical Engineering Co., Ltd.	432	656
English Electric Co., Ltd.	432	655
Metropolitan-Vickers Electrical Co., Ltd.	488	686
Johnson & Phillips, Ltd.	531	726
British Electric Transformer Co., Ltd....	567	839
Ferranti, Ltd.	573	926
British Thomson-Houston Co., Ltd. ...	579	775

5,000-kVA Scott-connected transformer—with booster regulator, &c. :—

Ferranti, Ltd. (Recommended.)	£2,730
English Electric Co., Ltd.	2,820
Hackbridge Electric Construction Co., Ltd. ...	2,918
British Electric Transformer Co., Ltd.	3,105
C. A. Parsons & Co., Ltd.	3,298
A.S.E.A. Electric, Ltd.	3,490
British Thomson-Houston Co., Ltd.	2,548
Metropolitan-Vickers Electrical Co., Ltd. ...	2,864
Johnson & Phillips, Ltd.	2,917
Brush Electrical Engineering Co., Ltd.	2,996

E.h.p. and h.p. switchgear :—

Metropolitan Vickers Electrical Co., Ltd. (Recommended.)	£10,712
Park Royal Engineering Co., Ltd.	10,712
Switchgear & Cowans, Ltd.	11,218
Johnson & Phillips, Ltd.	11,343
A. Reyrolle & Co., Ltd.	11,443
New Switchgear Construction Co., Ltd. ...	11,507
General Electric Co., Ltd.	11,575
Ferguson, Pailin, Ltd.	11,624
English Electric Co., Ltd.	11,679
British Thomson-Houston Co., Ltd.	11,795

Manchester.—Electricity Committee. Accepted :—
Single-phase a.c. meters.—Ferranti, Ltd.; Measurement Ltd.; Metropolitan-Vickers Electrical Co., Ltd.

Newbury.—Town Council. Accepted :—
135-b.h.p. electric motor, with pump, for the drainage pumping plant, at £899.—Hathorn, Davey & Co., Ltd.

Ramsgate.—Town Council. Accepted :—
Cable, electrical equipment and electric lamps for the Sands and Entertainments Committee (£207).—J. Carman.

Truro.—Public Works Committee. Recommended :—
Electric lighting at Town Quay.—Truro Electricity Supply Co.

Worthing.—Electricity Committee.
Converting plant and switchgear (£5,710 and £3,112 respectively).—British Thomson-Houston Co., Ltd.
Cable work in connection with the supply to Findon (£9,367), overhead extension from the Kennels to Muntham Court (£1,050).—Callender's Cable and Construction Co., Ltd.

Forthcoming Events.

Institution of Civil Engineers (Midland Area).—Friday, March 22nd. Chamber of Commerce Birmingham. 6 p.m. "Developments of the Generation and Distribution of Electrical Power in the British Isles." Mr. A. Page.

Junior Institution of Engineers.—Friday, March 22nd. 39, Victoria Street, S.W. 7.30 p.m. "Ventilation." Mr. D. A. Collin.

Birmingham Electric Club.—Friday, March 22nd. Grand Hotel, Birmingham. 7 p.m. Annual dinner.

Physical Society.—Friday, March 22nd. Imperial College of Science, South Kensington, S.W. 5 p.m. Annual general meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 23rd. South Wales Institute of Engineers, Cardiff. 6 p.m. "Power Factor: Its Cause and Effect." Mr. C. L. James.

(Lothians Branch).—Saturday, March 23rd. Philosophical Rooms, Edinburgh. "A.C. Winding."

(London Branch).—Saturday, March 23rd. Visit to Gas Light and Coke Co.'s Works at Beckton.

Royal Institution of Great Britain.—Saturday, March 23rd. 21, Albemarle Street, W. 3 p.m. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford, F.R.S.

Nottingham Society of Engineers.—Monday, March 25th. Victoria Station Hotel. 7.30 p.m. "Surface Condensing Plant." Mr. A. Beeston.

Institution of Electrical Engineers (North-Eastern Centre).—Monday, March 25th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Direct Generation of Alternating Current at High Voltages." Sir Chas. A. Parsons, F.R.S., and Mr. J. Rosen.

(North Midland Centre).—Tuesday, March 26th. Hotel Metropole, Leeds. 7 p.m. "The Testing of Porcelain Insulators." Mr. B. L. Goodlet.

(South Midland Centre).—Monday, March 25th. University, Birmingham. 7 p.m. "The Construction of the Grid Transmission System in Great Britain." Mr. Johnstone Wright and Mr. C. W. Marshall.

(Western Centre).—Monday, March 25th. Town Hall, Cheltenham. 6.15 p.m. "The Planning and Layout of a Rural Overhead Line." Mr. S. E. Britton.

(North-Western Students' Section).—Tuesday, March 26th. Engineers' Club, Manchester. 7.15 p.m. "High-voltage D.C. Transmission." Mr. D. G. Reed.

Electrical Power Engineers' Association (London Local Group).—Tuesday, March 26th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Foundations." Mr. J. C. Hughes.

Institution of Engineering Inspection. — Wednesday, March 27th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "Acoustics in relation to the Gramophone and Radio Loud-Speaker." Mr. A. M. Hallawell.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

"K" switches.
Duro pumps.
Virson cable connectors.

Notes.

Sir Hugo Hirst, Bart.

The following letter has reached us at the moment of going to press, too late for inclusion in our "Correspondence":—

The name of Sir Hugo Hirst has been added to those other names of super patriots of foreign origin already emblazoned upon the scroll of English history. Electrical engineers are generally so much occupied in their industrial interests that they have neither the time nor inclination to worry about the affairs of others, so that it may be necessary in this context to remind them of the list that begins with St. Augustine and includes almost every kind of social condition and occupation.

William the Norman; the Dutchman of the same name; George the First; the Prince Consort; Sir Anthony Vandyk; G. F. Handel; Joseph Conrad and others whose names escape me at the moment, because I am not writing with a book of biographical reference at my hand, have done their bit towards exalting the name of England.

Sir Hugo Hirst has thrown caution to the winds and has done his bit to rescue electrical engineering from the condition to which it had fallen in 1913. Some authorities say that we were run by the Germans at that date, others make us subservient to the U.S.A. In any case, whatever the tune may have been to which we danced in 1913, it was not English. In 1929 history seemed likely to repeat itself; we groaned under an intolerable bank rate which threatened to go higher, not a week passed but that we heard of the acquisition of our works or power companies by the foreigner; the prices of our electrical securities were forced up to dangerous heights from which the inevitable fall would land us in disaster, and our national pride, triumphant in 1918, suffered humiliation at the hands of the financial competitor.

Sir Hugo has struck a blow in our defence; he has arrested the artificial inflation of our electrical securities; he has reminded us of our duty to ourselves; has provided a rallying point whence our repulsed battalions may engage, and has generally raised Cain. I suggest, in recognition of his public services, that you, as our leading electrotechnical organ, should raise a fund to present him, in commemoration of his glorious act, with a copy of the "Declaration of Independence."

Epimetheus.

E.P.E.A. Dinner.

Mr. G. A. Goodall presided over the annual dinner of the Devon and Cornwall Section of the Electrical Power Engineers' Association at Plymouth on March 9th. The success of "The Association" was proposed by Mr. E. G. Okell, City of Plymouth electrical engineer, who spoke of the valuable work done in various centres by the Local Technical Groups of the Association, and response was made by Mr. A. N. Sendell (Bath). "The Electrical Supply Industry" was toasted by the general secretary of the Association, Mr. W. A. Jones (London), who reviewed the general advancement made by the industry. Mr. O. S. Hosgood (Cardiff), chairman of the Western Division, replied, and to the toast of "The Visitors," proposed by Mr. R. H. Lee, Mr. Turner responded. A programme of music and variety was provided.

Measuring Fluid Velocity.

A new method of effecting the measurement of fluid velocity has been devised by Profs. H. E. Hartig and H. B. Wilcox while carrying out the experimental programme of the American Society of Mechanical Engineers' Special Research Committee on Velocity Measurement of Fluid Flow, which they are conducting at the University of Minnesota. The method depends upon measuring differences of audio-frequencies, the fluid velocity being proportional to the frequency difference. In August last year a shielded 6-stage resistance-coupled radio amplifier with two 3,000-cycle tuned-input circuits was tested in connection with two magneto sound pick-up devices. It was found that the device as constructed could differentiate very sharply between frequencies differing by a very small amount, in the neighbourhood of 3,000 cycles per second. The experimenters are experiencing difficulty in finding two sound pick-up devices which do not introduce a phase shift in the two signals produced, over a sufficiently large range of frequencies. A number of expedients have been tried with commercial apparatus to eliminate this difficulty, so far without success.

An Irish Invention.

Benefits to the Irish Free State railways are expected to accrue from a patent which the Free State Government a fortnight ago voted £5,000 to acquire certain rights in, but the Minister refused to give any details. The inventor is Mr. James J. Drumm, who was born in Dundrum, Co. Down. After graduating from University College, Dublin, he went to Manchester in 1917 as an analytical chemist, and studied at the School of Technology. He then carried on research work in metals and collaborated in the production of chromium as used in stainless steel. Mr. Drumm returned to Dublin in 1920, and since then has devoted most of his time to research work at the National University.

Educational.

The Board of Education has issued Form 105 U (Ti) describing short courses for recognised teachers in technical schools, &c., which are to be held in 1929. They will include courses on engineering, science, and electrical engineering at Merton College, Oxford, from July 20th to 31st. Those desirous of attending them would apply to the Board on Form 106 U (Ti) before April 20th.

Accident.

Mr. Alexander Munro, Glasgow a Lloyd's surveyor, was killed, and Mr. Joseph Myers, chief electrical engineer, was injured on board the new P. and O. liner, *Viceroy of India*, at the Tail-of-the-Bank, Greenock on March 4th. The vessel, which is undergoing trials on the Clyde, was returning to the anchorage when the accident occurred. When one of the anchors was being lowered the pin came out of one of the shackles and the anchor rattled down into the water at terrific speed. The shackle-pin rebounded, struck Mr. Munro a glancing blow on the right side, and knocked him down. Mr. Myers was hit on the left shoulder and thrown to the deck. A tug was summoned, and both men were taken aboard. Mr. Munro died before the vessel reached the shore.

St. George's Chapel, Windsor.

According to the *Daily Telegraph*, the experiment is being made of installing electric light in the choir of St. George's Chapel, Windsor Castle. The nave and side aisles have been illuminated by electricity for many years, but the choir for the last five centuries has been lighted by candles. Six electric chandeliers, each carrying five lamps, have been temporarily suspended from the vaulted roof, and various tinted globes have been tried to see which produce the most effective glow. The object is to secure that the light shall be thrown downwards, not around and upwards. Electric radiators were installed over a year ago, because it was found that the heating apparatus was practically useless during the work of renovation. The choir of St. George's has been restored at a cost of over £100,000, and the nave is now being renovated.

Cable Sheath Losses and Carrying Capacity.

In an article by Messrs. Herman Halperin and K. W. Miller, in a recent issue of the *Electrical World*, evidence is given of the increase obtained in the current-carrying capacity of single-conductor cables by the elimination of sheath losses. In 1926 the Commonwealth Edison Co. began the installation of single-conductor underground cable on three-phase, 60-cycle, 66-kV lines, and on 12-kV leads to transformers feeding the lines. Since calculations showed that if the sheath losses were eliminated the carrying capacity of the two sizes of cable would be increased, it was decided to make trial installations with various kinds of insulating sleeves, bonding apparatus and methods of bonding. It was found that the elimination of the sheath losses from three-phase, 60-cycle, 66-kV lines, consisting of single-conductor 750,000-circular mil cables installed in conduits with other cables, increased the average yearly carrying capacity from approximately 50,000 to 60,000 kVA, or about 20 per cent. Since the total investment cost of the installed cable is approximately $60,000 per mile of line, or about $1.20 per kVA-mile, the increased investment value resulting from the elimination of sheath losses is, therefore, approximately $12,000 per mile of line. An additional saving is made in the cost of reduced sheath losses, which is about $1,000 per mile of line per year, assuming 55,000 kVA average yearly rating and a 60 per cent. load factor. Capitalised at 10 per cent. per year, this represents an additional investment saving of $10,000 per mile of line.

Electric Vehicles in France.

An active campaign with the object of popularising the use of electric vehicles throughout France is being conducted by the Société pour le Developpement des Véhicules Electriques, a body which corresponds to the Electric Vehicle Committee in this country. Two two-day meetings have lately been held in Paris, to which representatives of the principal French railways, harbour, and dock authorities, various motor-using Government Departments, members of Chambers of Commerce, &c., were invited to listen to a series of papers on the subject of electric vehicles, see lantern displays of their uses, and to witness road demonstrations of different types of electromobiles. Similar demonstrations are to be organised at a number of the trade fairs to be held in France this year.

The Electrical Association for Women.

Recently members of the Leeds and West Riding Branch of the E.A.W. held their first luncheon at the Queen's Hotel, Leeds, at which the Lord Mayor of Leeds (Alderman D. B. Foster), Miss C. Haslett, director, E.A.W., and Mr. W. B. Woodhouse, engineer and manager, Yorkshire Electric Power Co., were present.

On February 26th, a party of E.A.W. members, including the president, Mrs. Wilfrid Ashley, and the Viscountess Elibank, visited the electric restaurant kitchen car of the London and North-Eastern Railway Company at King's Cross Station. Members were received by Messrs. Hind, Gresley and Sutcliffe on behalf of the company. The chef and the engineer were also in attendance, and explained how so many passengers could be catered for and served in so small a kitchen.

The inaugural meeting of the Bristol and District Branch of the E.A.W. was held on March 5th.

At a recent meeting of the South Wales and Monmouthshire branch of the Association, Mr. J. W. Beauchamp, M.I.E.E., engineer and manager of the South Wales Electrical Power Distribution Co., gave some interesting figures concerning the consumption of electricity in the home.

By kind invitation of the British Thomson-Houston Co., Ltd., and the Hotpoint Electric Appliance Co., Ltd., members of the Association visited the Ideal Home Exhibition on March 13th and were entertained to luncheon and tea. The party numbered over 300, including members from Birmingham and the Midlands, Cheltenham, Gloucester, Rugby, Ashford, Bristol and Cardiff. Demonstrations were given of the latest electric lighting, heating, cooking, refrigeration and labour-saving appliances. After luncheon the members adjourned to the Hall of Music, kindly lent by His Master's Voice Gramophone Co., when Mr. F. W. Leevers welcomed the party on behalf of the B.T.H. Co., and gave a most interesting address on the steadily-growing appreciation of the advantages of electricity in the home.

A one-day conference has been arranged by the Association for April 16th, when a meeting of members will be held at the Hotel Cecil (London) at 11.15 a.m. to discuss the work of the Association and receive reports from headquarters and the various branches throughout the country. At a luncheon on the same day the speakers will include Mrs. Wilfrid Ashley, president, E.A.W., Sir John Snell, chairman, Electricity Commissioners, Lt.-Col. K. Edgcumbe, president, Institution of Electrical Engineers, and Lady Emmott, president, National Council of Women of Great Britain. In the afternoon a party will leave the Hotel Cecil by motor coaches to visit the works of Messrs. Belling & Co., at Edmonton and Enfield, to see the manufacture of electrical "outlet" equipment. The day's programme will conclude with a ball at the Hotel Cecil. Mrs. Wilfrid Ashley will receive guests at 9 p.m. Tickets for the luncheon and ball can be obtained as follows: Combined, 25s. each; luncheon, 6s. each (exclusive of wines); ball, 21s. each.

Appointments Vacant.

Electrical artisan (£380) for the Nigerian Government Railway. Lecturer in electrical engineering for the City of Leicester Education Committee. Charge engineer (£250) for the City of Canterbury Electricity Department. Charge engineer for the Stoke-on-Trent Corporation Electricity Department. Electrical mechanical engineer for the Government of Palestine Public Works Department (£550). Three temporary sub-station attendants for the Stepney Corporation Electricity Department. Draughtsman (£414) for the Hammersmith Borough Council Electricity Department. Shift engineer for the Borough of Darwen Electricity Department. (See our advertisement pages to-day.)

An Electrostatic Voltmeter.

At a meeting of the Physical Society of London, Dr. E. H. Rayner demonstrated a standard electrostatic voltmeter and wattmeter used for measuring a.c. at power frequencies at the National Physical Laboratory. The voltmeter indicates up to about 120 volts on a scale about 18 ft. long, and the quadrant electrometer designed for use as a wattmeter has a similar scale. They are of the type used as the national standards for such work, in which accuracy is of primary importance; as regards sensitivity, they must be considerably superior to commercial apparatus, the errors of which it is their purpose to determine. The voltmeter is used commonly at 100 or 110 volts, higher voltages being measured on accurate potential dividing resistances; at 100 volts the scale divisions are about 80 mm. per volt, enabling values to be measured to 0.01 volt over a large part of the range of the instrument. The latter is of the multicellular type with "needles" specially shaped to open up the bottom and top parts of the scale, which are normally much more contracted than the middle part. The suspension is a bifilar one, fine tungsten wire being used; a horizontal aluminium disk in oil provides the damping. The wattmeter is a more delicate instrument, the torque available being much less than in the case of the voltmeter; its nominal range is 100 or 110 volts on the "needle" and 2 volts on the quadrants. The needle is of thin aluminium alloy with stiffening ribs which have been pressed up in it by means of a grooved metal die. Blotting paper is used to press the metal foil into the die under pressures up to 10 tons. No oil damping is permissible; the separation of the quadrants is about 2 mm., which is sufficiently small to provide, with the grooving of the needle, the necessary amount of air damping. The separation naturally affects the sensitivity, so that the sensitivity, damping, and grooving are interdependent. The scale deflection with 100 volts on the needle and 2 volts on the quadrants is about 12 ft. Mechanical adjustments are provided for levelling the quadrants and varying their separation, and for moving them round inside the casing, so that they can be oriented in any desired direction as regards the position of the needle. The insulation is made of "amberite." Special calibrating resistance boxes are made for the voltmeter and wattmeter, and selector switches are also required, the one for the wattmeter being of some elaboration, since the needle and quadrants must never be open circuited in passing from one method of connection to another, or from one circuit to another.

An Italian Electrical Endowment.

On behalf of the board of directors of the Edison Electric Co., of Milan, Signor Motta, a deputy, has presented Signor Mussolini, Prime Minister of Italy, with a sum of 10,000,000 lire (about £100,000) to provide scholarships for foreign travel and scientific research. They are to be administered by the Italian Academy, says *The Times*, and the fund is to be called the Alessandro Volta Foundation. The Edison Electric Co. has also decided to increase its grants to the Milan Polytechnic with the object of assisting scientific studies.

Therapeutic Light Treatment.

A warning against extravagant expectations relative to the value of artificial-light treatment is contained in the recently-published report of the Medical Research Council. Its comments on the subject are reported to be, *inter alia*, as follows: It would seem to be the duty of those who take the responsibility of prescribing light treatment, not only to secure that its known dangers shall be avoided, but also to find and announce evidence of its benefits that do not come only from strong commercial advocacy and popular credulity. It would seem also to be the special duty of hospitals and schools, and other clinics, expending large sums of public money upon artificial light to use part of the expenditure to demonstrate by properly-controlled trials their justification for spending more. Prolonged research has provided no scientific reason at all to suppose that the treatment of rickets, or the supply of vitamin D to the body, is better effected by ultra-violet rays falling on the skin than by the direct provision of the necessary food values. The use of artificial light to supply only what the right food can give is merely wasteful. It commonly costs 3s. or 4s. to furnish by light an effective supply of vitamin D that would cost less than 1d. if taken through the mouth in the form of cod liver oil, or otherwise. The discovery of the powerful intervention of sunlight in nutrition led naturally to the suggestion, and even to the expectation, that it might act beneficially in other unrevealed ways. It was hoped that it might have other beneficial effects on child life besides its indirect value in supplying a vital food constituent. Following an experiment, no evidence could be found of any gain. When conditions between children with and without treatment were equalised, the results of the light were negative. The council is aware of no properly controlled experiments which have been made elsewhere to set against these results. The last report of the chief medical officer of the Ministry of Health shows that the results collected from artificial-light centres provided by local authorities exhibit much variation of opinion. No objective evidence is provided that results have been achieved that could not have been far more cheaply gained by proper food, and if that be so it is obvious that exercise and fresh air are greatly preferable to indoor sessions around a lamp.

The fact that light does cause an increase in the power of the blood corpuscles, as tested in shed blood, to dispose of bacteria has been largely used as a justification for the recent advocacy of light treatment, but such increased power, as shown in the laboratory, has not yet been correlated with any permanent effects of value in the body. It is quickly followed by a decrease of bactericidal power (power to kill bacteria), which not only soon returns to the normal, but at least sometimes goes below it afterwards. There is no present reason to know that artificial light can do more in this way than a mustard plaster, which is infinitely cheaper. The council draws attention to the various negative results because it had had the responsibility of expending public money in support of those researches which give the real, and perhaps at present the only, sanction for light treatment.

Rural Trend of Industry.

That the availability of electric power at cheap rates in rural areas will probably lead to the tide of industry running back from the towns to the country is the prophecy contained in a report dealing with South Buckinghamshire and the Thames-side that has been issued by the local Regional Planning Advisory Committee, for whom it was prepared by Mr. W. R. Davidge, a past president of the Town Planning Institute. Electricity supplies, it is pointed out, "should enable the establishment of cottage industries to be a practical undertaking, and may lead to vigorous manufacturing activity in light industries in what are now purely agricultural centres. The report contains a survey of the geographical character of the region, its people and their occupations, the existing public utility services, and transport facilities.

Institution Notes.

Institution of Electrical Engineers.

The annual dinner of the North-Midland Centre of the Institution took place on March 12th, at the Hotel Metropole, Leeds, Mr. F. S. G. Hinings (chairman of of the Centre) presiding over a gathering of close upon 100 gentlemen.

Proposing the toast of "The Institution," Mr. J. J. H. STANSFIELD, F.C.I.S., said there was no doubt the industry owed a tremendous debt of gratitude to it.

Lt.-Col. K. EDGCUMBE, T.D., R.E., president of the Institute, in response, said he was glad to learn that special efforts had been made to get the students to that gathering. He referred to the hope of the Council to improve the usefulness of the Students' Section, and invited the District Centres to do their best in the way of helpful suggestions. The electrical industry had made itself indispensable to big brother industries, such as mechanical engineering, and co-operation of that kind would go far to improve British production generally, but it must be recognised that if industries generally were not doing well, the electrical industry could not expect to prosper alone. He believed, however, there were definite signs of a general improvement.

Mr. W. B. WOODHOUSE (past-president of the Institution), proposing a toast to the guests, said he was particularly glad to note the close association between the electrical engineering industry and those who were engaged in teaching the science and practice of it. The industries of this country had been going through a very bad time, but out of adversity he believed some good was emerging. One of the most valuable outcomes of the troubles of industry had been the vast improvement in relationships between employers and employed. Another important development had been the great reorganisation now going on in industry; it was fashionable now to call it rationalisation. Undoubtedly it had to be recognised that the commercial unit of to-day must be on a larger scale than twenty years ago.

Professor F. C. LEA, O.B.E., D.Sc., responding on behalf of the guests, suggested that the Institution, which had already done much to encourage young men in scientific training, should still further encourage them to stay at the universities and do research work, and even when they left the universities to continue in the spirit of research even if they were bound by industrial duties to give less time to direct research. As one who had travelled a good deal, he was inclined to think some other nations had utilised young scientifically trained men rather more than this country had.

STUDENTS' DINNER.—The twenty-second annual dinner of the London Students' Section was held on March 5th at Les Gobelins' Restaurant. The number of members and guests was nearly 140, including Mr. P. V. Hunter, Mr. H. T. Young, and Mr. P. F. Rowell; the chair was taken by Mr. S. H. Hart. In toasting "The Institution of Electrical Engineers," Mr. L. S. Crutch drew attention to the fact that 25 per cent. of its members were students, and nearly 25 per cent. of the latter were members of the London Section. Mr. P. V. Hunter replied, and Mr. Moffatt, in proposing "Our Guests," mentioned that the Section had some lady members. Mr. Cousins replied. "The Students' Section" was proposed by Mr. H. T. Young, who regretted the poor attendance at meetings, the average being 60. Mr. S. H. Hart, in a short reply, said that the attendance at the dinner was the largest they had had for six years.

SUMMER MEETING.—At the invitation of the Société Française des Electriciens, the summer meeting of the Institution this year will be held in France. The following is a brief outline of the programme, full particulars of which will shortly be issued in the form of a circular to the members:—

Tuesday (June 11th), leave for Paris, where visits will be paid to various power stations, the wireless station at Sainte-Assise, the Carnot central automatic telephone exchange, &c., excursions to Versailles, Malmaison, Chantilly, and Sevres, and on the evening of Wednesday (June 12th) there will be a banquet offered by the Société Française des Electriciens.

Sunday (June 16th).—Leave Paris for Bordeaux and the Pyrenees, with a stop at Eguzon to inspect the dam and the hydro-electric station of the Paris-Orléans railway.

Monday (June 17th).—Leave Bordeaux for Pau, where the party will be entertained at dinner by the South-Western Local Centre of the Société Française des Electriciens; visits to places of interest near Pau, including the Houra works and Eaux-Bonnes, the party proceeding to Loudres in the afternoon of Tuesday (June 18th). Next day there will be excursions from Loudres to works at Soulom and Gavarnie, and the party will leave Loudres for Toulouse in the afternoon of June 20th. On the Friday (June 21st) there will be an excursion to the old city of Carcassonne, returning to Toulouse in the evening.

Saturday (June 22nd).—Leave Toulouse for Paris, arriving there about 10 p.m.

The approximate cost of the Paris portion of the meeting will be from £12 to £19 10s. (depending on the class of hotel and route), and that of the whole trip (Paris and the Pyrenees) from £21 to £28 10s., which will include all transport, hotels, and meals (except luncheons and dinners in Paris, and wines). The very low cost of the Pyrenees trip is due to the fact that the Paris-Orleans and Midi Railways have generously agreed to provide railway transport for the party free of charge; in addition, the Chemin de Fer du Nord is transporting the party from Calais (or Boulogne) to Paris and *vice versa* at half fare.

The Physical Society.

The annual report of the Council for 1928 shows that 14 ordinary science meetings were held at which 33 papers were presented and 10 demonstrations given; the average attendance at meetings was 67. At the eighteenth annual exhibition, arranged jointly by the Physical and Optical Societies the total attendance was estimated at about 5,000. In January the Council passed unanimously a resolution that any Fellow having reached the age of 65, and having retired from the practice of his profession or business, may apply to the Council to remit, or reduce, his future annual subscriptions, provided his Fellowship of the Society has been continuous for at least 25 years. As a result of the labours of the Publications Sub-committee several important changes have been introduced. The number of honorary Fellows on the roll on December 31st, 1928, was 10, ordinary Fellows numbered 691, and students 47.

During the year the membership's net increase was 29, raising the total to 747. The total income of £3,503 exceeded the expenditure by £98.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. G. S. HAYDON, resident engineer and manager of the Nottingham Corporation's North Wilford power station, is severing his connection with that undertaking. Mr. Haydon superintended the construction of the North Wilford station as resident engineer for Messrs. Preece, Cardew & Rider, consulting engineers.

Mr. S. T. DAVIES, deputy borough treasurer, of Accrington, has been appointed secretary to the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board.

Mr. J. C. DENISON-PENDER, elder son of the late Sir J. Denison Denison-Pender, has been elected chairman of the Eastern Extension Telegraph Companies and the Western Telegraph Company. Mr. Denison-Pender, who was born in 1882, entered the cable service after leaving Eton, and went through all branches, including important cable-laying expeditions. He is a director of many cable companies, also banking and insurance companies. Mr. Pender's elder son recently joined the Eastern Telegraph Co.—the fourth generation of the Pender family to enter the service.

Mr. W. J. TERRY has been appointed deputy chairman of the London Electric Wire Company and Smiths, Ltd., and Mr. ERIC L. WILDY has been elected a director of the company.

Sir PHILIP DAWSON is in Egypt for the purpose of advising the Egyptian Government respecting a number of electrical matters.

Mr. W. L. HICHENS is one of the members of the recently-constituted board of the English Steel Corporation, Ltd.

Mr. JOHN DAWSON, for 34 years electrical engineer to the Marquis of Zetland on the Aske Estate, near Richmond, Yorkshire, has retired.

The Stockport Town Council has appointed Mr. W. L. CHUBB as mains superintendent.

Sunderland Town Council has appointed Mr. C. A. HOPKINS, general manager of Wigan Corporation Transport Department, as engineer and general manager of Sunderland Corporation Tramways, at a salary of £800 per annum. Mr. Hopkins, who succeeds the late Mr. A. R. Dayson, has been manager at Wigan since 1925, and previous to that was chief assistant from 1919.

The Worcester City Council has appointed Miss K. M. SHAW as lady demonstrator at the electricity showrooms at a salary of £160 a year, rising to £200.

The Tilbury Urban Council has referred back to committee a recommendation to pay the electrical superintendent the salary laid down in the E.P.E.A. schedule, *viz.*, £485 per annum, as from April 1st next.

According to the *Industrial Australian and Mining Standard*, the recently appointed electrical sales manager of the Victorian State Electricity Commission (Mr. D. E. Williams) was leaving Sydney on February 7th for the United States and Canada, to study at first hand all matters related to the sale of electrical energy and the merchandising of electrical appliances by undertakings which, like the Commission, generate and distribute electricity on a large scale.

Mr. S. T. Davies, who has been in the service of the Accrington Corporation for 21 years, has been appointed secretary of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board

Mr. Charles N. Pickworth, Wh. Sch., who for 40 years has been editor of the *Mechanical World* and associated publications, has now retired from that position. Mr. Pickworth who is the author of several technical works, including the well-known book "The Slide Rule," will continue his consulting practice. His new address is 17, Griffiths Drive, Southport.

Obituary.—Mr. A. A. Simon.—We regret to record the death, which occurred on Friday, March 8th, at his residence in London, following a short illness, of Mr. Antony Andre Simon. Mr. Simon was born of French parents in Moscow, and was educated in that city. Following graduation from the Imperial University in Moscow, he joined the Russian Dynamo Company as a sales engineer. This company was at that time representing the old British Westinghouse Company, and in 1914 Mr. Simon was transferred to the British Westinghouse Company's staff then maintained in Russia. Although at first acting purely as a technical translator, within a few months he demonstrated his outstanding ability as a sales engineer, and up to the time of the Revolution he carried out many important negotiations for the British Westinghouse Company. In the disturbances following the Revolution he lost practically all his possessions. After several adventurous months he came to England, where he rejoined the British Westinghouse Company's staff, first in Manchester and later in London. For many years past Mr. Simon has held the position of manager of Continental sales for the Metropolitan-Vickers Company, and he was also a director of several subsidiary companies operating on the Continent. His duties entailed considerable travel throughout Europe, and he was consequently well known in practically every Continental country. He was a man of charming personality, which, in addition to his great abilities, both as a linguist and as an engineer, brought him an exceptionally wide circle of friends. The funeral service was held on March 11th at the Russian Cathedral Church in Kensington, and the interment took place at the Brompton Cemetery. The service was attended by a large number of Russian and British personal and business friends, including many past and present directors of the Metropolitan-Vickers Company and its subsidiaries both at home and abroad.

Mr. F. W. Metcalfe.—We regret to record the death of Mr. Frank Walker Metcalfe, B.Sc., manager of the Machine Section of the Contract Department, British Thomson-Houston Co., Rugby. Mr. Metcalfe, who was only 38 years of age, was a man of exceptional attainments, and his loss will be greatly felt, not only by his colleagues at Rugby, but by the large circle to whom he was well known throughout the country. After nine years with Messrs. Yates & Thom, he joined the British Thomson-Houston Co. in 1915, and made rapid progress until the time of his death. Apart from his engineering career, he did exceptionally good work in connection with the Adult School movement. Some two years ago he made an extended tour in Japan, spending some time in India on the return journey. The body was cremated on Saturday last, and the memorial service was held in the Rugby School Chapel. Mr. Metcalfe leaves one little son and a widow, with whom the utmost sympathy will be felt.

Mr. Chas. Stanley.—We learn with feelings of deep regret of the death, which occurred on Monday, under tragic circumstances, at Alcester, of Mr. Charles Stanley, general manager of the British Industries Fair at Birmingham, and director of the National Trades Exhibition at Bingley Hall, Birmingham. He had recently suffered from influenza and family bereavement. In our various meetings with Mr. Stanley in connection with the Fair at Castle Bromwich, we have always found him to be most courteous and willing in rendering assistance to the Press. Those responsible for the organisation of the Birmingham Section will badly miss him, though in their future operations they will benefit from the efficient manner in which he has laid down the lines that have led to success.

Mrs. W. Frisby.—We regret to learn that Mrs. Lily Frisby, wife of Mr. William Frisby, borough electrical engineer of Colchester, passed away on March 12th as a result of pneumonia, following influenza.

Wills.—The late Mr. A. T. Hollingsworth, of *Engineering*, left £210,152 gross and £190,497 net personalty.

Mr. A. R. Macdonald, of Bournemouth, left £9,726 gross and £9,673 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

J. Smith & Son (Brighton), Ltd.—Private company. Registered March 13th. Capital, £12,000 in £1 shares. Objects: To acquire the business now carried on at Brighton and elsewhere by Mary A. Smith and J. D. Smith as "J. Smith and Son," and to carry on the business of heating, lighting and electrical engineers, &c. The directors are:—J. D. Smith, "Hillsdown," Heath Road, Haywards Heath; Mrs. Mary A. Smith, 21, Windlesham Gardens, Hove; H. L. Smith (managing director), 23, Cissbury Road, Hove. Secretary: P. F. Spooner. Registered office: 33 & 34, North Road, Brighton.

British Meters, Ltd.—Private company. Registered March 14th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of gas, water, electrical and other meters, &c. The subscribers (each with one share) are:—D. W. Child, 132, Perry Rise, Forest Hill, S.E.23, solicitor's clerk; H. Pushee, 4, Mornington Street, Regent's Park, N.W.1, law writer. Registered office: 34, Castle Street, Liverpool.

Genuine Co., Ltd.—Private company. Registered March 12th. Capital, £10,000 in 8,000 ordinary "A" shares of £1 each and 40,000 ordinary "B" shares of 1s. each. Objects: To acquire the business of a manufacturer of and dealer in gramophones, wireless and general electrical goods, &c., carried on by Max Bilantz at 546, Harrow Road, W., 13 & 77, High Street, Harlesden, N.W., and at 364, Edgware Road, W., as the "Genuine Company," and the business carried on by him at 200, Portobello Road, Kensington, as "Lewis Turner & Company." The subscribers (each with one ordinary "B" share) are:—S. Gorrie, 32, Rosebank Avenue, Wembley, accountant; R. Greenhalgh, Wiggin Hall, Watford, accountant. The first directors are:—M. Bilantz (permanent governing director and chairman), T. Turower, and Miss Millie Bilantz. Secretary: A. W. Bedingfield, 42, St. James Road, S.W.9.

Blythe & Marden, Ltd.—Private company. Registered March 12th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in electrical, optical, photographic, wireless and scientific instruments and appliances, &c. The directors are:—B. S. M. Blythe, 22, Croydon Road, Caterham Valley; F. J. Marsden, Millford, Markville Gardens, Caterham Valley. Registered office: 26, Croydon Road, Caterham Valley.

Broadcasting Lampshades, Ltd.—Private company. Registered March 11th. Capital, £200 in 1s. shares. Objects: To carry on the business of wholesale, retail and export manufacturers of and dealers in all kinds of lamp shades, lamps, lighting apparatus, loud speakers, wireless receivers and components, gramophones, electrical and mechanical instruments and apparatus, &c. The permanent directors are:—J. Phillips, 146, Broadhurst Gardens, West Hampstead, N.W., company director; E. Joseph, 15, Vale Court, Maida Vale, W., merchant.

Imperic Radio Gramophone Manufacturing Co., Ltd.—Private company. Registered March 6th. Capital, £100 in £1 shares. Objects: To carry on the business of designers and manufacturers of and dealers in television and sound-producing and reproducing instruments, gramophones, ribbon

records for gramophones, &c. The directors are:—T. F. Farrimond, 13, Virginia Road, Thornton Heath, company director (chairman); R. E. Townshend, 7, Woodend, Sutton, Surrey, electrical engineer (both permanent).

S. Hathaway & Co., Ltd.—Private company. Registered March 15th. Capital, £1,500 in £1 shares. Objects:—To carry on the business of electricians, mechanical engineers, manufacturers of and dealers in radio telephones and telephonic and telegraphic and telegraphic apparatus, parts and accessories, &c. The first directors are:—S. F. Hathaway, radio factor (managing director); and T. A. Veavon (traveller), both of 91, Durning Road, Liverpool; E. W. Hathaway, 7, Moscow Drive, Stoneycroft, Liverpool, traveller (all permanent). Registered office: 3, Bold Place, Liverpool.

W. E. Amies & Co., Ltd.—Private company. Registered March 12th. Capital, £2,000 in £1 shares. Objects:—To acquire the business of manufacturers of mouldings and synthetic materials carried on by G. L. Ackland and W. E. Amies as W. E. Amies & Co., at 36 and 38, Matilda Street, Sheffield, and to acquire from the said W. E. Amies a patent relating to improvements to an electrical plug fuse-switch and contact blocks and the like. The subscribers (each with one share) are:—W. E. Amies, 407, Fulwood Road, Sheffield, engineer; G. L. Ackland, 24, Thornsett Road, Sharrow, Sheffield, commercial traveller. Solicitors: Slater & Elliott, 39, Bank Street, Sheffield.

Electric Lamp Distributors, Ltd.—Private company. Registered March 15th. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers, importers, exporters and sellers of electric lamps of all kinds, electrical accessories, cables, commodities appertaining to electrical industries, &c. The first directors are:—A. Siderman, 51, Cleveland Street, Fitzroy Square, W.1, electrical factor; Miss I. Cornes, 12, Crayford Road, Holloway, N.7, clerk. Registered offices: 55/63, Goswell Road, E.C.1.

Official Returns of Electrical Companies.

Watson-Norrie, Ltd.—Debenture dated March 2nd, 1929, to secure £1,800 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. A. Nelson, 23, Eldon Place, Newcastle-upon-Tyne.

H.E.C. Electric Co., Ltd.—Capital, £1,000 in 400 preference and 600 ordinary shares of £1 each. Return dated October 15th, 1928. 170 preference and 203 ordinary shares taken up. £173 paid on 170 preference and 3 ordinary shares. £200 considered as paid on 200 ordinary shares. Mortgages and charges nil.

West Wilts. Electric Light & Power Co., Ltd.—Capital, £100,000 in 10,000 preference shares of £5 each and 50,000 ordinary shares of £1 each. Return dated September 5th, 1928. 1,700 preference and 22,608 ordinary shares taken up. £31,108 paid. Mortgages and charges nil.

Wakelins Wireless Co., Ltd.—Capital, £2,500 in 1,250 preference and 1,250 ordinary shares of £1 each. Return dated December 1st, 1928. 135 ordinary shares taken up. £102 paid. £33 considered as paid. Mortgages and charges, £675.

Kent Bros. Electric Wire Co. and E. H. Phillips, Ltd.—Capital £15,000 in £1 shares. Return dated December 31st, 1928. 11,500 shares taken up. £500 paid. £11,000 considered as paid. Mortgages and charges, £20,000.

Craven & Speeding Bros., Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1929. 10,000 shares taken up. £10,000 paid. Mortgages and charges nil.

East India Tramways Co., Ltd.—Capital, £150,000 in 15,000 preference, 35,000 ordinary and 100,000 deferred shares of £1 each. Return dated November 23rd, 1928. 7,476 preference, 33,433 ordinary and 100,000 deferred shares taken up. £7,489 paid on 7,476 preference and 7 ordinary shares, and including £6 paid on 24 preference shares forfeited. £133,426 considered as paid on 33,426 ordinary and 100,000 deferred shares. Mortgages and charges nil.

Shirebrook Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 10th, 1929. 4,800 shares taken up. £1 per share called up on 2,800 ordinary and 5s. per share on 2,000 ordinary shares. £3,200 paid, leaving £100 in arrears. Mortgages and charges nil.

Radio Service (London), Ltd.—Satisfaction to the extent of £125 on February 15th, 1929, of debenture dated July 25th, 1927, securing £2,750.

Reed, Evans & Co., Ltd.—Capital, £100,000 in £1 shares. Return dated December 31st, 1928. 92,292 shares taken up. £6,576 paid (£1 on 657 and 4s. on 29,595 shares). £85,716 considered as paid (£1 on 62,040 and 16s. on 29,595 shares). Mortgages and charges nil.

Yale Electric Power Co., Ltd.—Capital, £20,000 in 3,300 preference shares of £1 each and 668 ordinary shares of £25 each. Return dated December 4th, 1928. 525 preference and 668 ordinary shares taken up. £15,525 paid on 525 preference and 600 ordinary shares. £1,700 considered as paid on 68 ordinary shares. Mortgages and charges, £5,226 3s. 5d. (bank overdraft secured by £6,000 debentures).

Precision Radio & Manufacturing Co., Ltd.—Mortgage debenture dated March 2nd, 1929, to secure £100 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. C. Powers, 56, Fleet Street, E.C.4.

Albion Shades, Ltd.—Particulars filed of £2,000 debentures authorised February 20th, 1929, charged on the company's property and assets, present and future, including uncalled capital, the amount of the present issue being £1,200.

Izzard Bros., Ltd.—W. B. Pearson, 5, John Street, Bedford Row, W.C.1, was appointed receiver and manager on February 28th, 1929, under powers contained in certain debentures dated December 22nd, 1925.

Gas and Electricity Development Co., Ltd.—Capital, £2,000 in 1,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each. Return dated December 31st, 1928. All shares taken up. £2,000 paid. Mortgages and charges nil.

City Notes.

General Electric Co., Ltd.

As we briefly stated in our last issue, the shareholders at an extraordinary meeting on March 13th approved resolutions providing for the creation of 1,600,000 British ordinary shares, to be non-transferable to foreigners, and the public issue of 1,500,000 of these shares. Addressing the meeting, Sir Hugo Hirst, Bt. (chairman and managing director), said that shortly after the war the need became evident for a big and powerful electrical concern in this country to be built up based partly on stock ownership in the concern, as was done so frequently in America and other countries. In the midst of their programme of extension, however, the difficult days of 1921 arrived, and they had to issue debentures. He had never ceased to regard 7 per cent. debentures as a blot on the balance sheet of a company such as theirs, and he had been waiting ever since for a favourable opportunity to redeem them. By redemption and occasional purchases they had reduced the debentures by approximately £400,000, and they now desired to redeem the balance without weakening the cash resources of the company. The directors' proposal to issue these shares to the British public had apparently given umbrage in some quarters, but he believed that the criticism was entirely due to a misunderstanding of their objects. He had always held the conviction that a company like theirs received strength and support from the fact that its shares were held by people who were users of its products and who took an interest in its development. It had been his ideal that some day the "G.E.C." might mean to the people of this country what the "G.E.C." meant to the people of America and the "A.E.G." or Siemens to the people of Germany, a national institution. During the last twelve months dealings in the company's shares had started in the Kerb Market of New York. They accordingly took steps last September to ensure that any attempt to secure foreign control should be made impossible. In spite of that, purchases in the United States continued, raising the price of the shares to an abnormal extent, and on returning from Australia he found that considerably more than a half of the ordinary share capital had wandered across the Atlantic. Thus they had been deprived of 60 per cent., if not more, of their ordinary shareholders, to whom they looked for support in the home market; 70 or 75 per cent. of their business was in the home market. It was absolutely vital that apart altogether from control, the company's British character should be preserved, and therefore its shareholders should include in their number the greatest possible percentage of British subjects. It was for these reasons only that it was proposed to confine the present issue to the British public. The American public who before long might hold practically all their ordinary shares issued, were barred from giving them this help by their protective fiscal legislation. In order to achieve this object and to avoid any suggestion that they were unduly favouring any class of shareholders, British or otherwise, they were not making this issue to the public themselves. Subject to its authorisation by the meeting, they had sold 1,500,000 shares to the British, Foreign and Colonial Corporation at £2 per share, leaving it to allot the shares at a price not exceeding £2 2s. per share to such British subjects as they thought fit, with definite instructions to distribute the shares amongst the greatest number of applicants without regard to whether they were shareholders or not. Any future increase of dividend or capital bonus would go to the whole of the shareholders according to their holding without any discrimination. It was absolutely incorrect to think that the price of £2 2s. made it a bonus issue. Several first-class independent issuing houses had advised them that the price was a fair one, compatible with the yield on industrial

shares in this country of similar class and prospects. Owing to the wealth and prosperity which America enjoyed, investors in that country appeared to be content with a smaller return for their money. As the result of the issue they would have in hand £3,000,000 to pay off their debentures. That, on a dividend of 10 per cent., which he had every reason to believe would continue to be paid, meant, at 40s. per share, a cost to them of 5 per cent. The debentures bore 7 per cent. interest, and that would be a saving to the ordinary shareholders of £60,000 per annum. They would have an additional £1,500,000 to reserve; the security of the preference shareholders would be enhanced by the removal of £3,000,000 debentures at present standing in front and the addition of £3,000,000 more capital behind them; and, finally, they would have a large additional and permanent body of British shareholders to preserve and maintain the traditions of the company. This proposal had no object but which he, as managing director, and his colleagues considered as essential if the company was to continue its upward career. There were no personal interests concerned. The proxies showed that the vast body of the shareholders supported them.

Sir Hugo then moved the first resolution, providing for the increasing of the capital; this was seconded by Mr. E. G. Byng and carried practically without dissent. Upon the second resolution, providing that the 1,600,000 new shares should be called "British ordinary shares" and should be held only by British subjects, there arose a lengthy discussion. It was opened by Mr. D. Kingdon, who quoted comments from *The Times* to the effect that the new shares should be offered to the whole of the shareholders as they carried valuable rights. The market point of view was put forward by Mr. J. J. Barnard, who also considered that the shareholders were being deprived of their rights. After other shareholders had spoken, Mr. Noel Berridge expressed the view of the Committee of American shareholders that the action of the board was unfair to them and the general body of shareholders. It was suggested that the meeting should be adjourned for the purpose of allowing the board to reconsider its proposals in the hope that it would allot the shares to the whole of the ordinary shareholders. The chairman said that the matter had been considered from every angle and no useful purpose would be served by an adjournment. Mr. Berridge accepted this ruling but said that his committee would have to take such steps as were advised. Mr. E. G. Humphreys, speaking on behalf of the holders of the depositary receipts issued by the Guaranty Trust Company, New York, said that in September last the American shareholders had shown their confidence in the board by raising no protest against the arrangements designed to secure British control of the company. They now considered that their confidence had been misplaced. After the expression of other views Sir Hugo Hirst said that the board had no control over Stock Exchange influences; their business was to carry on manufacturing in the best manner to earn profits for the shareholders. This was a matter of life or death to the company. The board could not possibly carry on if it could not be sure that it had the moral support of the great bulk of the holders of the ordinary shares. He was sorry to have to be a pioneer in this matter, but he was certain that the company's example would have to be followed by others in the national interest. The resolution, which was seconded by Mr. M. J. Railing, was carried by an overwhelming majority, as was the third resolution altering the articles of association. A vote of thanks was enthusiastically accorded to Sir Hugo Hirst.

The American shareholders' committee appealed to the State Department. The latter replied that while it was unable to intervene it had instructed the American Embassy in London to watch developments with a view to rendering any assistance possible.

A further cable was sent to the company by the American Shareholders' Committee asking for a postponement of the issue pending negotiations. In reply to this Sir Hugo Hirst announced that after consultation with the company's financial advisers they had decided to hold up the issue of the new shares. A plan had been elaborated which, in their opinion, would satisfy the shareholders while safeguarding the company's policy, and it was suggested that representatives should be appointed by the committee to discuss the new proposals.

The Committee replied that Mr. T. L. Chadbourne, its chairman, and Mr. H. B. Swope would sail for England in the *Aquitania* on Saturday, or in the first available vessel, to discuss the matter. Sir Hugo Hirst suggested that to save time it would be better for the Committee to appoint someone in London who would be in constant touch with it by cable and telephone. He said that the company was on the point of completing proposals drawn up on lines which, it was felt, would meet all reasonable criticism levelled against the first proposals.

In response to this the Committee expressed dissatisfaction, and reiterated its desire that representatives from America should discuss the matter with the board itself and not with the board's financial advisers.

Marconi International Marine Communication Co., Ltd.

The annual meeting was held on March 11th, when the deputy chairman and managing director (Mr. F. G. Kellaway) said that the year had been one of preparation for the new order of things that would come into force at the end of 1929, resulting from the decisions taken at the International Radio-Telegraph Convention at Washington in 1927. After the end of this year no more spark transmitters would be fitted on board ship. Designs of ships' wireless telegraph and telephone apparatus had been made to meet the new requirements, and they were being offered at prices which approximated very closely to the standard figures for spark outfits. Referring to the "Four-second Auto-alarm" device, Mr. Kellaway said that reports from nearly 1,000 ships equipped with this apparatus showed that the device had an efficiency of not less than 90 per cent., with prospects of improvement as further experience was gained. The wireless direction finder was being employed to an increasing extent. Another feature of 1928 was the increase in the use of wireless in trawlers. To date there were 191 trawlers and drifters carrying the company's apparatus. The possible market was about four times this figure. The company had begun the present year with a large number of orders in hand for execution, promises of many more, and the prospect of less adverse effects from reduced wastage through sales of ships abroad and for breaking up. In connection with the recent announcement that the Gramophone Company ("H.M.V.") had acquired the Marconiphone Company, and that in future the Marconi Company, which owned the Marconiphone Company, would have a substantial interest in the development of the gramophone and wireless business so far as it applied to receiving sets, and to the entertainment and educational fields, he said that this arrangement was the first step taken in this country to put the broadcasting reception and entertainment business on a rational footing. Under the arrangement the Wireless Company would no longer be directly concerned with wireless in its application to the entertainment and educational fields, but would confine its activities to research and invention in wireless generally, to its manufacturing business as carried on at Chelmsford, and to the development of its traffic services. Mr. Kellaway referred with regret to the death of Sir J. Denison-Pender. The report and accounts were adopted.

London Electric Supply Corporation, Ltd.

The annual meeting was held on March 13th, when the Earl of Bessborough, who presided, said that sales during 1928 were 203,711,271 kWh, as compared with 162,047,193 kWh in the preceding year, an increase of more than 25 per cent. This was due to additional railway demands and to a large increase in the domestic and industrial loads. The average price obtained per kWh had fallen from 1d. to 0.816d. With regard to the London Electricity (No. 2) Act, 1925, which provided for the setting up of standard prices for electricity, the benefits consumers had received during 1926, 1927, and 1928, due to their being charged less than the standard price, amounted to approximately £300,000. The purchase of the Deptford power station by the London Power Co. was completed during the year, and a new station was being erected on an adjacent site by the London Power Co., which would ultimately have a capacity of 200,000 kW. A new "all-in" tariff had been introduced, and although this tariff had only been in operation for one month, it had been adopted by a large number of consumers. A new showroom was to be opened in the residential area. The future business of the company was solely that of distribution, and expenditure would be incurred on sub-stations, transformers, and cables. Electricity was purchased from the London Power Co., but the supply was not on the standard system, and new sub-stations and a network of cables on the standard system would be laid down for all future extensions. It was hoped that the standardisation, not only of electricity, but all forms of apparatus, would lead to more economical generation and a lower purchase price for appliances required by the consumer. An employés' pension scheme had been introduced at the commencement of the current year. The report and accounts were adopted.

British Insulated Cables, Ltd.

The directors report a profit of £617,951 for the year ended December 31st, 1928; this compares with £609,242 for the preceding year. A balance of £305,880 brought forward is added making £923,831. After making provision for debenture interest, preference and interim ordinary dividends, &c., there remains £783,389 which it is proposed to deal with as follows: To depreciation on buildings, plant, machinery, &c., £100,000; to reserve account, £299,966; final ordinary dividend of 10 per cent. (again making 15 per cent. for the year); leaving £250,089 to be carried forward. As already reported, it is proposed to distribute, by way of bonus, 333,333 ordinary shares in the proportion of one new share for each four held, together with 500,000 "A" 5½ per cent. preference shares of £1 each in the proportion of three new shares for each eight already held; the shares will rank for dividend from January 1st, 1929. A proposal is also to be made at the annual meeting on March 26th that a capital sum of £50,000 be set aside from the reserves to form a fund, the interest on which will be used at the directors' discretion to provide compassionate allowances for the workpeople and their dependants. The directors regard the result of the year's working as satisfactory. The reserve against investments being considered no longer necessary, the amount (£185,034) has been added to the reserve account on the other side of the balance sheet. The report records the resignation from the board of Mr. J. C. Stitt, and states that during the year Mr. D. Sinclair relinquished the position of managing director (remaining chairman), Mr. G. H. Nisbett being appointed in his place. Mr. D. Johnstone Sinclair has recently been elected a director.

Scottish Power Co., Ltd.

Presiding at the annual meeting on March 13th, Mr. George Balfour (chairman) said that it had been decided to make available a supply of electricity over a considerable portion of the Grampians area from existing power stations so as to develop the growth of the load while the hydro-electric works were being constructed. Consumers were being connected in Auchterarder and were being supplied from the company's power station at Bonnybridge pending connection with the main transmission system of the Grampians Co. A supply would be extended to Blackford and other districts towards Perth as soon as possible. Regarding rural electrification, supplies were being brought into a large rural area by means of transmission lines provided last year and under construction. The one great essential to enable supplies to be given to hamlets was a further relaxation of conditions regulating pole and transmission line details so as to reduce the mileage cost of these lines. Good progress had been made with extensions to the steam power stations at Bonnybridge and Arbroath, and the work would be completed during the early summer of this year. The combined generating plant installed would then amount to 32,500 kW. The electrical energy sold amounted to 35,457,000 kWh, as against 32,600,000 in 1927, and the maximum supply demanded was 12,340 kW. A commencement was made with the construction of the hydro-electric works of the Grampian Co. at Rannoch, the preliminary installation of which would consist of two units having a total capacity of 32,000 kW. The report and accounts were adopted.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Presiding at the annual meeting on March 14th, the chairman (Col. R. E. Crompton) said that the capital expenditure during the year was £37,861, most of which was due to laying down additional mains and material in converting stations. The policy announced last year of providing mains suitable for the new standardised system of a.c. distribution was being proceeded with, and work had already started in one part of the area which required that suitable static transforming substations would have to be provided, involving further capital expenditure. Reductions made in electricity charges had resulted in benefits amounting to £45,258 to consumers during 1926, 1927, and 1928. The showrooms had been successful, and were largely responsible for the increased use of electric cookers by consumers. An additional 1¼ million kWh was purchased during the year. The report and accounts were adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The report for the year ended December 31st last states that the connections rose by 29,119 h.p. to 716,678 h.p. The profit for the year was £819,456 (as compared with £783,493 for 1927). From this debenture interest is met and £150,000 is reserved for special depreciation and contingencies (the same), and £60,500 for plant renewals and improvements (against £50,000). To the balance of £404,286 is added £43,206 brought forward, making £447,492. The final ordinary dividend is 3¼ per cent., making 6 per cent. for the year (as for 1927), and £80,633 is carried forward. During the year £60,426 was charged against the reserve for plant renewals and improvements. Capital expenditure amounted to £318,811, representing mainly extensions of the distribution system. An issue of 925,000 ordinary shares offered to the shareholders at 23s. 6d. per share, in November last, was largely over-applied for. Meeting: March 26th.

Liverpool Overhead Railway Co.

The annual meeting was held on March 13th, Alderman M. H. Maxwell (chairman) presiding. In moving the adoption of the accounts, the chairman said that the enlarged advertising scheme was well carried out, and the fact that the shipping companies were granting permits to passengers to view liners in the docks on several days a week resulted in large numbers of visitors taking advantage of this, thereby increasing the traffic receipts, particularly in connection with the round trip tickets. The expenditure for the year showed a decrease of £3,589, the percentage to traffic receipts being 82.43, against 89.21 in 1927, 104.07 in 1926, 99 in 1925, and 98.31 in 1924. The reasons for this decrease were mainly staff economies and reduced cost of electricity. The railway had carried 7,511,559 passengers during the year, an increase of 183,383 as compared with 1927. The notification by the Mersey Dock Board of its intention to make Liverpool a free port for goods exported coastwise should help very materially, and any increase in traffic to be handled at the docks should benefit the company.

Waygood-Otis, Ltd.

The annual meeting was held on March 15th, when the chairman (Mr. H. C. Walker) outlined the progress of the lift service from the hand-operated lifts to the automatic signal control lift which permitted a speed of 900 to 1,000 ft. per minute. He said the policy of the Central Electricity Board to introduce a standard a.c. system had necessitated many alterations in design and manufacture of lift apparatus involving new types of motors and controllers. The company had actually supplied a large number of installations for speeds up to 400 ft. per minute on a.c. Referring to the manufacture of escalators, Mr. Walker said this type of apparatus was not only used for underground railways, but had also been adopted in many department stores in Great Britain, the Dominions and the Continent. Vertical transportation was now generally recognised as being of as great importance as horizontal transportation. There was no part of the equipment of a modern building which would give so handsome a return on the investment as a high-grade lift equipment. He referred with regret to the death of Mr. Charles Clarke, joint managing director. The report and accounts were adopted.

Folkestone Electricity Supply Co., Ltd.

In their report for the year ended December 31st last the directors state that the connections rose by 789 kW to 9,561 kW. Including receipts from hired installations, the profit amounts to £40,781 (against £41,920); to this is added £2,047 brought forward, and interest, and after deducting debenture interest, preference dividend, &c., there is a balance of £39,019. From this, £11,249 is allocated to depreciation, £8,000 to reserve, and £1,000 to employés' superannuation fund. An issue of 35,000 new ordinary shares was made during the year; these rank for dividend from July 1st, 1928. A final dividend of 6 per cent., free of tax, is recommended on the old ordinary shares (making 10 per cent., tax free, for the year), and one at the rate of 10 per cent. per annum, free of tax, on the new ordinary shares. The report states that the company's rating assessment has been considerably increased, and notice of appeal has been lodged.

Bristol Tramways and Carriage Co., Ltd.

The gross revenue for the past year amounted to £1,145,474, and the net revenue (including the balance brought forward) to £118,185, against £111,285 in 1927. After the usual appropriations, a final dividend of 4 per cent. is recommended on the ordinary shares (again making 7 per cent. for the year); £15,000 is transferred to the reserve fund for contingencies and renewals, and £3,786 is carried forward. Interest on investments has been carried to the reserve fund, which now stands at £421,945. Both the tramways and carriage departments showed increased receipts; the total number of passengers carried rose from 107,634,308 to 112,168,239. The death is recorded of Mr. Samuel White, J.P., who had been successively secretary, managing director and chairman of the company. Mr. W. G. Verdon Smith, C.B.E. (managing director) has been elected chairman, and Mr. F. N. Cowlin has been appointed to the board.

Imperial Tramways Co., Ltd.

After meeting debenture interest and interim preference dividend, the balance available for 1928 is £13,678 (against £14,469). The balance of the preference dividend is paid, and the ordinary shares receive 5 per cent., leaving £878 to be carried forward. The company's holding in the London and Suburban Traction Co., Ltd., was disposed of during the year and the proceeds were used to pay up calls on Bristol Tramways & Carriage Co. ordinary shares. Mr. W. G. Verdon Smith has been appointed chairman in the place of the late Mr. Samuel White, and Mr. S. E. Baker has joined the board.

Mersey Power Co.

The report for 1928 records an increase of about 6 million kWh in the sales of energy; the connections have risen to 54,500 h.p. The Minister of Transport has authorised an increase in the maximum charge for certain areas under the Runcorn Electric Lighting Order; this will enable the company to extend into those areas. Issues of capital totalling £708,975 during the year have enabled the company to redeem the balance of the Government 6 per cent. mortgage and 6 per cent. second debentures. The working profit for the year, plus interest received, was £100,869; a net amount of £16,420 brought forward is added, making £117,289. After meeting interest charges and issue expenses, it is proposed to pay 5 per cent. on the ordinary shares, to place £30,000 to reserve, and to carry forward £17,081. Meeting: March 26th.

Newcastle and District Electric Lighting Co., Ltd.

The accounts for the year ended December 31st last show a profit of £72,809, as compared with £76,236 in 1927. To this is added £15,658 brought forward, and after the deduction of debenture interest, &c., there remains available £70,534. From this, £4,970 is allotted to second mortgage debenture, &c., funds; £22,000 to depreciation; and £10,000 to general reserve. A dividend of 7½ per cent. is recommended on the ordinary shares (as for 1927) and a balance of £15,564 remains to be carried forward. Since the end of the year under review, 150,000 £1 ordinary shares have been offered to the shareholders at 24s. 6d. each; these were fully subscribed. The company moved into its new offices last year, and opened a showroom there. The meeting is to be held to-day (Friday).

Telegraph Construction and Maintenance Co., Ltd.

The net profit for the year ended December 31st last fell from £115,135 to £106,144, but the 1927 figure included a sum transferred from reserves which were not required. The addition of £112,618 brought forward makes available £218,762. After transferring £15,000 to reserve (against £20,000), the directors recommend a final ordinary dividend of 7½ per cent., free of tax, again making 10 per cent., tax-free, for the year;

a balance of £114,122 is carried forward. The report states that the orders received and the general business of the company were on a relatively small scale. The c.s. *Colonia*, which was built in 1902 for the purpose of laying the first Pacific cable, was disposed of during the year. The meeting was to be held yesterday (Thursday).

Llanelly and District Electric Supply Co., Ltd.

The profit rose from £42,463 in 1927 to £53,705 during the past year. After providing for debenture interest, the preference dividend, &c., and placing £19,000 (against £13,500) to reserve, a balance of £3,327 is carried forward. The last distribution on the ordinary shares was 5 per cent. in respect of 1925. In view of the depression in the district, the increased profit is considered satisfactory. A new turbo-alternator was put into service during the year, and extensions to Kidwelly and Gowerton are in progress. In the course of the year £50,000 of debenture stock was issued and the authorised capital was increased by 100,000 6 per cent. preference shares and 50,000 ordinary shares.

Hendon Electric Supply Co., Ltd.

The report for 1928 states that after meeting debenture interest and the interim ordinary dividend, there is an available balance of £39,811. From this £4,728 is placed to general reserve, £8,293 to repairs and renewals fund, and £5,900 to income tax account. It is proposed to pay a final ordinary dividend of 2s. per share, free of tax, making 15 per cent. for the year, as for 1927. The net balance carried forward is £9,628. During the year the 6 per cent. debenture stock was paid off, and £200,000 of 5 per cent. debentures were issued.

Midland Electric Corporation for Power Distribution, Ltd.

It is reported that the profit for the year 1928 was £154,460, as compared with £194,922. The balance brought forward is £9,128 making £163,588. The ordinary dividend is reduced from 15 per cent. to 8 per cent. (interim of 6d. per share paid), and £24,549 is carried forward. Last year a 100 per cent. bonus issue was made, thus on the old capital the distribution is 16 per cent. At last year's annual meeting the chairman stated that it was not expected that there would be any immediate increase in the aggregate amount of dividend.

Lancashire Dynamo and Motor Co., Ltd.

After providing for obsolescence, depreciation and debenture interest and crediting dividends from subsidiary companies, the total profit for 1928 is £21,003 (as compared with £19,726 for 1927), and the addition of £5,350 brought forward makes available £26,353. The preference dividend and directors' fees are paid, £5,000 is transferred to reserve, and 5 per cent. is again to be paid on the ordinary shares, leaving £7,809 to be carried forward. During the year the Crypto Co. purchased the business of the Langham Engineering Co., which specialises in the manufacture of self-contained gears for electric motors. Meeting: March 26th.

Automatic Telephone Manufacturing Co., Ltd.

A profit of £123,670 is recorded in the 1928 accounts, after providing £50,000 for depreciation; this compares with £171,359 for 1927. A balance of £81,755 brought in is added, making £205,425. After meeting directors' fees and preference and interim ordinary dividends, £35,000 (against £15,000) is transferred to reserve, leaving £137,233. It is proposed to pay a final ordinary dividend of 6¼ per cent., again making 10 per cent. for the year, and, in addition, a bonus of 2½ per cent. is recommended; £93,483 remains to be carried forward. The directors consider the results to be satisfactory. Meeting: March 26th.

International Automatic Telephone Co., Ltd.

The profit rose from £124,369 in 1927 to £130,823 last year. A final dividend of 6¼ per cent. (again making 10 per cent. for the year) is to be paid on the ordinary shares, together with a bonus of 2½ per cent. The deferred shares are also to receive a 10 per cent. dividend and a 2½ per cent. bonus. £10,000 is placed to reserve and £69,734 is carried forward.

Davis & Timmins, Ltd.

Speaking at the annual meeting on March 14th, the chairman (Mr. F. Le Neve Foster) said that satisfactory results had followed the company's acquisition during the year and the consequent alterations of the capital. The outlook was most encouraging; the turnover during the first two months of this year was in excess of that for the corresponding period of 1928. They had repaid the whole of the debentures of the subsidiary companies; to meet this and to provide further finance the directors proposed to issue at an early date the remaining 3,000 ordinary shares.

Pinchin Johnson & Co., Ltd.

The net profit for the past year was £422,796, as compared with £327,942 in 1927 (when £26,000 non-recurring profit was included). The final ordinary dividend is 20 per cent., making 30 per cent. for the year, as for 1927. Of the balance, £67,000 is placed to reserve, and £80,103 is carried forward. A portion of the reserve funds is to be capitalised and distributed in the form of ordinary shares to existing ordinary shareholders in the proportion of one new share for each three held. Meeting: March 25th.

American Telephone and Telegraph Co.

The accounts for 1928 show a total revenue of $235,781,978, net earnings of $165,268,049, and a net income, after deducting interest, of $143,170,491. Dividends absorbed $103,821,440, leaving $39,349,051 to be carried to surplus. The operating revenues of the Bell System totalled $660,059,821 and the net income $191,087,639. After the payment of dividends amounting to $119,348,612, a balance of $71,739,027 remains.

Tees Power Station Co., Ltd.

The profit for the past year was £122,231, as compared with £85,672 for 1927. After meeting debenture interest the directors propose to pay a dividend of 6 per cent. (against 5 per cent.) and to carry forward £750, against £1,311 brought in. During the year the authorised capital was raised to £992,978 by the creation of 17,978 £1 shares; the Newcastle-upon-Tyne Electric Supply Co., Ltd., has been allotted 20,000 shares.

Isle of Thanet Electric Supply Co., Ltd.

This company's report for 1928 was reviewed in our last issue (p. 486). The annual meeting was held on March 13th, when Mr. A. R. Monks (chairman), who presided, said that the lighting and power business of the company continued to develop, and they looked for increased revenue from that source. The board had no knowledge of any proposal relative to the purchase of the undertaking by one of the larger electricity supply companies.

English Electric Co., Ltd.

Speaking at the annual meeting on March 18th, Mr. W. L. Hichens (chairman) referred to the great improvement in the results, and said that there were solid grounds for hoping that under normal conditions and with the same volume of orders they might look forward with confidence to continuing on the up-grade, although progress might be slow. A fuller report of the speech will appear in our next issue.

Aluminium Corporation, Ltd.

At meetings of the holders of the company's debentures and shares last week approval was given to the proposals to sell the company's hydro-electric undertaking to the North Wales Power Co., to reduce the capital from £1,000,000 to £808,508 10s. by writing 10s. off the ordinary shares, the sub-division and conversion of the preference shares into ordinary shares, and the restoration of the capital to £1,000,000.

County of Durham Electrical Power Distribution Co., Ltd.

A profit of £59,299 (against £44,966) is shown in the accounts for the past year. A balance of £887 brought forward is added making £60,186, and after meeting debenture interest, &c., an ordinary dividend of 6 per cent. is recommended (as in 1927), leaving £1,224 to be carried forward.

British Aluminium Co., Ltd.

After meeting debenture charges, &c., placing £50,000 to depreciation reserve, £100,000 to reserve fund, and £10,000 to staff benefit fund, and adding £27,858 brought forward, the profit for the past year is £151,921. It is proposed to pay a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year (as for 1927), and to carry forward £33,843.

Mid-Cheshire Electricity Supply Co., Ltd.

After providing for debenture interest and depreciation, the net profit for 1928 was £9,254; to this is added £1,609 brought forward, making £10,863. It is proposed to pay a dividend of 5 per cent. on the ordinary shares, to write £500 off new issue expenses, and to place £350 to employés' dividend bonus account, leaving £1,833 to be carried forward.

Associated Gas and Electric Co.

The Times states that the Associated Gas and Electric Co. has concluded a contract to acquire control of the General Gas and Electric Corporation. This transaction, it is stated, will place the company among the seven or eight largest power groups in the United States.

Postal Telegraph and Cable Corporation.

The directors have declared a quarterly dividend of 1¾ per cent. on the 7 per cent. non-cumulative preferred stock, payable April 1st.

Eastern Telegraph Co., Ltd.

A dividend of 2½ per cent. on the ordinary stock, free of tax, for the quarter ended December 31st, 1928, has been declared.

Eastern Extension, Australasia & China Telegraph Co., Ltd.

The directors have declared a final dividend for 1928 of 5s. per share, free of tax.

Brompton and Kensington Electricity Supply Co., Ltd.

The ordinary shares are to receive a final dividend of 10.706d. per share, making up the standard dividend for the past year.

Elgin Electric Supply Co., Ltd.

Out of the profit of £2,701 for 1928 the directors are paying a dividend of 5 per cent.

Power Corporation of Canada.

The company is issuing $10,000,000 of series "B" 4½ per cent. 30-year debentures. These will be convertible into no-par-value common stock within a five-year period.

Vickers, Ltd.

A dividend of 8 per cent. has been declared on the ordinary shares, as for 1927.

Chelsea Electricity Supply Co., Ltd.

A final dividend of 11.3d. per share, making up the standard dividend for the past year, has been declared on the ordinary shares.

Egham and Staines Electricity Co., Ltd.

The profit for the year 1928 was £32,661, as compared with £29,507 in 1927. A dividend of 7½ per cent. is again recommended on the ordinary shares.

Ward & Goldstone, Ltd.

An interim dividend of 3½ per cent. has been declared.

Swedish Company.

The *Allmänna Svenska Elektriska A.B.* (*A.S.E.A.*) is raising a debenture loan at 5 per cent. amounting to 20,000,000 kr. The proceeds are to be devoted to the extension of the Swedish workshops, the establishment of new foreign organisations, and the financing of the newly formed subsidiary company, the Elektro-Invest, which is to establish electricity works abroad. The share capital of the A.S.E.A. amounts to 75,000,000 kr.

The company's report for 1928 states that during 1928 it received orders for and delivered a large number of generators, transformers and electrical apparatus of various kinds to concerns in Sweden, England, Norway, Belgium, Denmark, Holland, Italy, Poland, Canada and other countries. The company now has 7,210 employés in Sweden and has established new branch offices in Bombay, Calcutta and Melbourne. The net profit for 1928 was 4.65 million kr. and the dividend remains unchanged at 6 per cent.

South London Electric Supply Corporation, Ltd.

The balance of the "standard" dividend (5½ per cent.) is to be paid on the ordinary shares.

County of London Electric Supply Co., Ltd.

The directors recommend a final ordinary dividend of 7 per cent., making 10 per cent. for the year (against 7½ per cent. for 1927). The dividend is supplemented by an appropriation in respect of the company's extra-London interests.

South Metropolitan Electric Light & Power Co., Ltd.

A final dividend of 5½ per cent. is recommended on the ordinary shares, making 8½ per cent. for the year. This dividend is supplemented by an appropriation for the company's interests outside London.

Clyde Valley Electrical Power Co.

The directors' report for the year ended December 31st, 1928, shows a profit of £304,296 (as compared with £288,166 for 1927); to this is added £84,290 brought forward, making available £388,586. The interim ordinary and preference dividends are met and £120,000 is transferred to contingency fund. It is recommended that a final dividend of 5 per cent. be paid on the ordinary shares, again making 8 per cent. for the year, and that £30,000 be set aside for the establishment of a staff benevolent fund, leaving £84,586 to be carried forward. The number of consumers now supplied by the company, directly and indirectly, is about 40,000. The Central Electricity Board has required the company to change its frequency of supply from 25 to 50 cycles; a special department has been set up for the purpose and the work is proceeding. Meeting April 3rd.

Stocks and Shares.

Monday Evening.

Stock Exchange markets continue to hang to a great extent upon the financial position in America. This is thought to have become materially relieved—at any rate, so far as the Bank of England is concerned—by a reported change in the method under which foreign capital is taken into New York. The effect of this alteration is, according to gossip, that foreign capital will receive no more than 6 per cent., whatever the rates may be which are ruling in America at the time. If this is the case, the 6 per cent. maximum is not likely to attract foreign gold to America to any great extent, and on this assumption it is taken for granted that the Bank of England position will become greatly strengthened, capital remaining in this country instead of being exported to America. The immediate effect was to bring about substantial rises in the prices of gilt-edged stocks, which rises were reflected in the firmness shown by investment securities of all kinds.

General Electric Issue Postponed.

The projected issue of 1,500,000 General Electric British ordinary shares was postponed at fifty-five minutes after the eleventh hour. Everything stood ready. Prospectuses were out: stockbrokers had circulated them amongst clients. Stags had filled up large numbers of forms. Investors had obtained advice from their counsellors as to whether or not to apply. Some General Electric shareholders resented the fact of outsiders as well as themselves being offered shares at 42s. The British, Foreign & Colonial Corporation had taken 1½ million shares at £2, and probably expected to make a profit of £150,000, less whatever sub-underwriting had been done, plus a certain amount of other expense. Candid comment became vocal that the Americans had some ground for protesting against the board's action. Then the issue was postponed. It may appear rather absurd that an issue of shares in a British industrial company—made, too, at a substantial premium—should have assumed sufficient importance to cause a hot-and-bothered atmosphere. But it did, and therefore the postponement of the issue, pending further developments, is a cause for satisfaction. On the resumption of business in the market, the shares rose from 57s. to 65s. It is thought that in any fresh arrangements which are made, the present shareholders will be given "rights"; hence the recovery, which amounts to 12s. 6d. on the week, in the price of the shares.

Marconi Shares.

Marconi shares have been a very active market, advancing to 4 1/16 on the news mentioned here last week to the effect that the company has entered into association with the Gramophone Company through the medium of the Marconiphone Co. Marconi preference have strengthened to 47s. 8d. Marconi Marines are 1/16 down at 3 3/16, the effect of the dividend disappointment being still felt. Canadian Marconis hold their rise at 38s. 9d. Negotiations are in progress for a working agreement between the Electramonic Company, and the Celestion. The issued capital of the latter company is £253,007; Electramonic's capital is £100,000. An Electric Shareholdings Trust which was contemplated in New York, and an issue in respect of whose shares was thought likely to be made, has been postponed owing to the discouragement that is offered to new financial issues at the present time on the other side of the Atlantic.

Eastern Cable Stocks.

The Eastern group of cable stocks and shares had been depressed until the money situation showed indications of brightening. Quotations promptly rallied, and previous declines were wiped out. Eastern Extensions show a gain of 10s. at 26½, and Westerns are 7s. 6d. up at 26. The new chairman of the Eastern, Eastern Extension and Western Companies, Mr. J. C. Denison-Pender, is well-known in connection with the cable industry.

Electrical Supply and Power.

Home electricity supply shares are what the Stock Exchange calls "dull for choice." County of London ordinary recovered to 53s. Egham and Staines are better at 36s. 6d. on the dividend of 7½ per cent., and the decision to issue new shares. Further good reports are being published by the London companies. The Kensington and Knightsbridge chairman very fairly described the result of the past year's operations in his company as being eminently satisfactory. Receipts from sales are better, and costs have been kept down to the lowest possible figure. The price of the shares is unchanged at 27s. Metropolitan Electrics are flat at 2½. Scottish Power have lost 6d. at 33s., Yorkshire Electrics are similarly lower at 35s. The crumbling process continues in Bournemouth and Poole, which show 1/16 loss at 67s. Midland Electric Power weakened to 2. The dividend on the ordinary capital, which a year ago was doubled, is to be 8 per cent., which goes against 15 per cent. on the smaller capital this time last year. Electrical Distribution of Yorkshire ordinary shares are quoted ex rights, at 36s. 3d., the new shares changing hands around 10s. premium. London Power new debenture stock is better at 12s. 6d. premium.

Kolster-Brandes.

The new Kolster Brandes shares started off at a premium of 27s. 6d., rose to 32s. 6d. premium, and then subsided to the neighbourhood of 16s. 3d. premium. The applications were so great that the issuing house had to resort to a ballot for the purpose of making the allotment, and, even so, the amounts which the fortunate few secured were comparatively small. People who thought there would be a repetition in the Kolster Brandes Company of what happened in connection with the Ford issue, when the Americans bought huge quantities of shares, and at rising prices, have been disappointed at the demand from the States being very much less for Kolsters than it was for the Fords.

Central Electricity Board Contracts.

Reference has already been made here to the very substantial contracts which the Central Electricity Board announced its intention of placing with British firms, in connection with State schemes for electricity supply. Further details are now available, the contracts amounting to approximately 3¼ millions sterling, and going to British Insulated Cables, Callender's, British Thomson-Houston, Pirelli-General, the General Electric Co., and others. The market in the shares of the various companies has been little affected by this announcement, for the reason that prices already stand tolerably high, and, with the pressure exerted by dear money, fresh buying has been restrained. Shareholders in the companies must feel, however, quite satisfied as regards the next year or two, that their undertakings will be provided with plenty of work, and that the dividends can be expected to remain at not less than their present level.

The Telegraph Construction Company, in its recent report, shows a lower profit than that earned in the previous twelve months, but the dividend is maintained at 10 per cent., and the reserve raised to £365,000. The reduction in net earnings is shown in the appropriation to reserve being reduced. The company is exceedingly strong as regards its finances, and shareholders who have waited long and patiently in the expectation of receiving some kind of a bonus, are not likely to feel any the less hopeful by reason of the figures that have just been presented.

Tubes and Trams.

Home Railway stocks show no vitality. Approach of the Easter holiday has failed to arouse any hopefulness in regard to possibly bumper traffics. The effect of the rise in petrol makes its influence still felt upon undergrounds. Moreover, the income bonds of the Underground Railways of London are said to be held fairly considerably in America, and the General Electric incident has led to some question as to whether Americans may elect to sell other British investments. (The case of Marconi is different from certain others, in that the company stated definitely that only 25 per cent. of its capital could be held by foreigners). After being heavy, the income bonds braced up to 111, so showing an advance of a point.

The London Tramway descriptions hold their prices. British Electric Traction deferred stock has been changing hands at 905, 915 and 930.

Manufacturing and Miscellaneous.

Callenders are better at 4 5/16, but in spite of a fine annual report from the company, British Insulated reacted to 4 11/16. Enfield Cable ordinary drooped to 5¼. Beyond these changes, the manufacturing list is quiet. Ever Ready shares eased off to 21s. 9d. The iron and steel issues went dull on the repetition by Vickers of last year's 8 per cent. dividend. Optimism looked for 10 per cent., and Vickers shed a few pence to 11s. 7½d. The English Steel Corporation has been formed to take over certain steel interests from Vickers, Armstrongs and Cammell Laird. A fall of 1/16 in Babcock & Wilcox has left the price at 3 7/16. Rubber shares followed a decline in the price of the produce to 1s. per lb. This appeared anomalous in view of the fact that the American consumption in February constituted a record, allowance being made for the month being a short one. Associated Electrical Industries—the former Metropolitan-Vickers—are 33s.; the £2 preference shares stand at 55s.

Foreign and Canadian Utilities.

The Mexican "revolution" seems to be progressing favourably for the course of law and order, but precise information is difficult to come by, and Mexico Tramways 5 per cent. bonds are 4½ points down at 77½. Mexican Light & Power failed to recover any of the drop of 11 sustained last week, and the 7 per cent. preferred shares further receded to 75¼. The Northern Mexico Power & Development Company has declared a dividend of 1 per cent. on its common stock. Brazilian Tractions are up 1, at 67.

Amongst other issues, Para Electric Railway shares are firmer at 8s. The preference shares at 21s. 6d. have risen 4s. Power Corporation of Canada strengthened a trifle to 115. Shawinigan is dull at 87½, and no particular changes have occurred in Montreal Light & Power at 110, or in Canadian General Electrics at 235. International Holdings remain at 9¼, Hydro-Electrics, which have been over 40, reacted to 39. British Columbia Power "A" shares at 53, and the "B" at 33, are attracting but little attention. Anglo-Argentine Tramways first preference, and the 5 per cent. debenture stock have gone back to 3 13/16 and 74, respectively.

Telephone Dividends.

The International Automatic Company and Automatic Telephone Companies have both declared dividends making 10 per cent. for the year, with a bonus of 2½ per cent. in each case. This was regarded as satisfactory, but as being no more than what had been expected for some time past. The price of Automatics is 42s. 6d., and of International Automatic B, 39s. 3d. Telephone Manufacturing eased off to 5s. 6d. Bogota Telephones show a small gain at 30s. International Telephone and Telegraph rallied to 225, after being several points lower.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1926.	1927.	Price March 18 1929.	Rise or fall	Yield p.c.
Bournemouth and Poole	1	14†	15	67/-	—1/16	... ...
Brompton Ordinary	1	8⅜	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8¼	8¼	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅛	8⅛	27/-	—	5 3 8
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7⅝	53/-	+3/-	2 16 7
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	24/6	—6d.	5 14 3
Elec. Supply Corporation	1	11	11	56/3	—	3 18 3
Kensington Ordinary	1	8	8	27/-	—	5 3 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/6	—	5 1 10
Metropolitan	1	8	9	2½xd	—⅛	4 4 8
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	27/6	—	4 8 3
Mid. Elec. Power	1	—	15	2	—⅛	4 0 0
Newcastle on-Tyne Ordinary ...	1	5	6	1¼	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—6d.	5 7 8
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	—6d.	4 17 0
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	44/6	—	... ...
Westminster Ordinary	1	8⅛	8⅛	26/-	—6d.	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	+3d.	6 1 3
Yorkshire Elec.	1	8	8	35/-	—6d.	4 11 5

†4% of which was tax free.

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	73	—	5 11 1
Metropolitan	,,	3	3	60	—	5 16 8
do. District	,,	£3	4	76	—	6 10 9
Underground Electric	£1	1½	5	24/-	—	5 16 8
do. do. Income ...	Bonds	6	6	111	+1	5 8 1

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24	—¼	6 3 9
Automatic Telephone	1	10	10	2⅜	—	4 14 1
Eastern Extension	10	10	10	26⅜	+½	*3 16 8
Eastern Tel. Ord.	Stock	10	10	260	—	*3 17 0
Globe Tel. and T. Ord.	10	10	10	26	—	*3 15 9
do. do. Pref.	10	6	6	11⅛	—	5 9 0
Great Northern Tel.	10	20	20	32	—½	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	5	*10	4⅛	+⅛	... ...
Marconi-Marine	1	8¾	12½	3⅞	—⅛	4 12 4
Oriental Telephone Ord.	1	12	12	3	—	...
Western Telegraph	10	10	10	26	+⅜	3 17 0

*Interim.

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3 13/16	—1/16	7 4 3
do. do. 2nd Pref. ...	5	6	6	4	—	7 10 0
do. do. 5% Deb. ...	Stock	5	5	74	—1	6 15 2
British Electric Traction Def. Ord.	,,	—	—	925	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	6	7	67	+1	2 19 8
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	96½	—	5 3 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	77½	—4½	6 9 0
Mexican Light Common	100	Nil	Nil	80	—	... ...
do. 7% Pref.	100	Nil	7	75½	—1	9 5 6
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	—	—	33/-	—	... ...
Babcox & Wilcox	1	13	15	3 7/16	—1/16	*4 7 3
British Aluminium Ord.	1	10	10	46/3	—	*4 6 7
British Elec. Transformer Pref. ...	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4 1/16	—1/16	3 3 3
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	15	15	4 5/16	+1/16	3 9 9
do. 6½% Pref.	1	6½	6½	1¼	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 3
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	5¼	—⅛	3 16 4
English Electric	1	Nil	Nil	8/8	—	... ...
do. do. Pref.	1	3	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	6½	6¾	24/6	—	5 6 1
do. Ord.	1	7½	10	3⅜	+12/6	2 19 6
Henley...	1	25	25	6	—	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	12½	10	1 1/16	—	5 3 1
Siemens Ord.	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction	12	10	10	25½	—	*4 14 3

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during February.

OUR extract from the February Board of Trade returns shows that there was a smaller volume of electrical exports during the month, as compared with January, but when regard is had to the fact that the month was three days shorter, the decline was more apparent than real; the daily average was actually a little higher last month than in January. The decrease was fairly general, but the machinery section showed the largest fall—£130,995 in the case of "other motors and generators." Other large decreases occurred in unenumerated electrical goods and apparatus (£78,647) and insulated wires and cables (£54,215). A notable increase is recorded for telegraph and telephone instruments and apparatus (£103,155), and batteries and accumulators showed a fairly substantial rise (£45,488). The month's figures were not greatly affected by the submarine cable item.

February, 1928, had an extra day, and that may account for the exports during that month being greater in value than last month's shipments. The principal variation was an increase of £61,972 in the value of exports of unenumerated electrical machinery, but this was partly offset by a total decline of £40,383 in the other two items in the machinery section. Non-submarine telegraph and telephone cables experienced the largest decrease (£43,456), but against this there was a rise of £41,349 in exports of batteries and accumulators. It is satisfactory to note that the improvement recorded for the first month of the year was not seriously affected by the February decrease.

The decrease of imports in February as compared with January is, of course, due to the same cause as the fall in exports, but in this case the daily average was lower, and so the decline was an actual one. By far the largest factor contributing to the decrease was electrical machinery, which fell in value by over 20 per cent. Other large decreases occurred in the cases of insulated wires and cables (£19,970) and batteries and accumulators (£11,704). There were only two increases, the more important being a rise of £4,711 in imports of non-submarine telegraph and telephone cables. As compared with February, 1928, in spite of the extra day in that month, there was an increase in imports of £28,292. This was mainly due to a rise of £56,931 in the case of telegraph and telephone apparatus, although imports of unenumerated goods and apparatus also rose to an appreciable extent. These and the other rises were partly offset by large decreases in imports of glow lamps (£25,069) and unenumerated electrical machinery (£19,596). It is not very satisfactory to see that imports so far this year have shown greater progress than exports.

There is little of interest in the re-export section, unless it be the two increases in the case of unenumerated electrical goods and apparatus.

The appended table analyses the exports of electrical machinery during February, and the figures are compared with those for the corresponding month of last year:—

	Feb., 1928.	Feb., 1929.	Inc. or dec.
	£	£	£
Destination.			
European countries ...	59,954	103,512	+ 43,558
Japan	37,557	17,317	− 20,240
South America	83,447	35,897	− 47,550
South Africa	37,370	28,466	− 8,904
British India	91,731	124,916	+ 33,185
Australia	40,632	97,330	+ 56,698
New Zealand	20,643	22,617	+ 1,974
Canada	11,909	13,603	+ 1,694
Other countries	106,945	68,119	− 38,826
Totals ...	£490,188	£511,777	+£21,589

It will be observed that, with the exception of South Africa, there were larger shipments of machinery to Empire markets, while non-Empire markets (except Europe) took smaller quantities.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Feb., 1929.	Inc. or dec. as compared with Jan., 1929.	Inc. or dec. as compared with Feb., 1928.	Electrical imports for Feb., 1929.	Inc. or dec. as compared with Jan., 1929.	Inc. or dec. as compared with Feb., 1928.	Electrical re-exports for Feb., 1929.	Inc. or dec. as compared with Jan., 1929.	Inc. or dec. as compared with Feb., 1928.
Electrical goods and apparatus (unenumerated)	£178,207	− £78.647	− £23,963	£120,540	− £9,737	+ £10,191	£7,264	+ £2,347	+ £2,598
Insulated wires and cables ...	219,090	− 54.215	− 20,535	56,481	− 19,970	+ 1,885	540	+ 59	− 160
Glow lamps	43.993	− 9,369	+ 7,009	20,922	− 1,405	− 25,069	865	+ 319	− 573
Arc lamps and parts ...	2,572	+ 746	+ 1,138	1,020	− 3,112	− 412	153	+ 133	− 48
Batteries and accumulators ...	113,556	+ 45.488	+ 41,349	43,805	− 11,704	+ 5,770	207	− 168	− 867
Meters and instruments ...	26,787	− 4,032	− 994	17,837	− 3,702	− 4,357	512	− 598	− 716
Carbons	677	− 218	− 923	12,993	− 178	− 114	224	+ 141	+ 12
Switchboards (not telegraph or telephone)	2,421	− 9,301	− 10,786	832	+ 613	+ 766	—	—	—
Electrical Machinery—									
Electrical machinery (unenumerated)	324,248	− 26,763	+ 61,972	120,780	− 35,874	− 19,596	8,624	− 342	+ 751
Railway and tramway motors	31,724	+ 6,096	− 30,236	—	—	—	—	—	—
Other motors and generators...	155,805	− 130,995	− 10,147	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	79,494	+ 12,352	− 43,456	8,492	+ 4,711	+ 2,297	45	+ 40	+ 45
Submarine telegraph and telephone cable	5,983	− 6,233	− 2,236	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	277,808	+ 103,155	+ 12,071	105,114	− 8,921	+ 56,931	2,966	− 509	− 416
Totals	£1,462,365	− £151,936	− £19,837	£508,816	− £89,279	+ £28,292	£21,400	+ £1,422	+ £626
	Exports			Imports			Re-Exports		
Inc. or dec. for two months ...	+ £47,773			+ £53,633			− £1,984		

Industry, Trade and Employment.

A Brief Review of the Balfour Committee's Final Report and Some Kindred Matters.

AFTER four and a-half years' work, during which six interim reports have been issued, the Committee on Industry and Trade, under the chairmanship of Sir Arthur Balfour, K.B.E., has completed its task. Its final report can be obtained from the Stationery Office (5s. 6d. net). It is impossible in the space at our disposal to do more than indicate the matters covered and summarise the Committee's conclusions. The main headings of the report are as follows:—

The Means of Access to External Markets in which tariff matters and commercial treaties, trade within the Empire, the machinery of commercial diplomacy and political obstacles to overseas trade, are considered.

Access to Means of Production covering such matters as materials, finance, transport and power.

Conditions of Employment in Relation to Competitive Power, which is a study of wages, hours, industrial peace, irregularity of employment, industrial welfare, &c.

Other Factors in Commercial Efficiency such as marketing organisation, industrial structure and combination, standardisation, education and efficiency, scientific research, industrial mobility, &c.

Public Charges in Relation to Competitive Power which deals briefly with national and local taxation and its effects.

British Customs Policy in Relation to Competitive Power in which tariff policy is treated.

Conclusions.

In its conclusions the Committee says that it makes recommendations in each section of the report and thus in the final section confines itself to certain broad results of a practical order on which the whole of its investigations appear to converge. While many causes of the existing economic situation existed before, and were only intensified by the war, others are the direct offspring of war conditions. Among the latter are the after-effects of the abnormal inflation of the "munition" industries, the loss of goodwill caused by the cutting off of external markets, the chaotic conditions of foreign currencies, the increase of trade barriers and the crushing burden of debt carried by the country. These factors have combined to impair the competitive power of British trade in overseas markets and the problems which arise are how to restore this competitive power without impairing the standard of living and how to enable British exporters to place their products in external markets in sufficient volume and on terms acceptable to overseas buyers. The survey makes it clear that organisation and equipment require thorough re-conditioning and this process necessitates the will and power to reorganise. A great deal of scrapping and replacement of plant will have to take place, and the industrial unit will have to be enlarged both by growth and by the re-grouping of units through consolidation or other forms of association, so as to obtain the full benefits of "rationalisation." On the other hand, great judgment, discrimination and restraint are necessary in carrying out the transformation, in order to preserve those special characteristics of variety and quality of products which have been the main strength of British industry and commerce. The human factor is of supreme importance and concurrently with the reorganisation of industry there should be an improvement in the quality of the higher control. This involves a great change in the attitude of the average business man towards new ideas, and in particular towards the results of scientific research and of higher education. It is suggested that a close study of the Report will assist in producing a type of industrial leader and administrator who will be capable of directing British industry and trade, as re-equipped and reconditioned, to the best advantage. The difficulty of depressed industries to raise the necessary capital for re-equipment is thought to be due not to any defects on the part of the banks and financial institutions or to the indisposition of the public to subscribe new capital, but to the inability of the industries to give security to the banks or offer an attractive investment to the public. While the general economic policy of the State may contribute to the solution of the problem, the first steps must come from the industries themselves. It is believed that the principal basic industries still have the power of regeneration within themselves. The necessary measures may include the writing-down of capital and the amalgamation of undertakings and these initial steps, painful as they may be, must be taken with courage and judgment. Reconstruction may at first involve an increase in the number of unemployed, but it is better to face this temporary evil than to drag on as at present. The evidence before the Committee convinces it that industrial relations are generally on a healthier footing than they have been for many years, and thus the present is an exceptionally favourable opportunity to take a further step in the direction of close and intimate co-operation. The full advantages of the reorganisation and reconditioning of works and equipment can only be reaped if the employés and their representatives are looked on as partners in a joint enterprise. There is an urgent need for managers and workpeople to adopt a better appreciation of the advantages of mobility, *i.e.*, transfer, industrial or geographical. To produce the best results an end must be made of trade restrictions and demarcation rules from which this country suffers more than any other. There are indications that leaders of labour organisations are learning to appreciate the importance of the relaxation of such rules. Industrial fatigue and the whole range of questions generally classed as "welfare" will need much greater attention in the future. The Committee concludes:—"We confidently hope that all these new demands and new duties will find the ready and general response which the situation requires and the nation expects."

In a memorandum seven members of the Committee, while agreeing with the facts presented in the surveys, dissent from the general conclusions and suggest, *inter alia*, the nationalisation of some important industries and greater State control.

The Liberal Party's Policy.

Last week the Liberal organisation published a pamphlet—"We Can Conquer Unemployment"—setting out the party's proposals for dealing with unemployment. The means put forward are the development of road construction, housing, telephones, electricity supply, land drainage, London passenger transport, &c. After stressing our backwardness in telephone development as compared with some other countries, proposals are put forward for greater publicity and financial provisions to accelerate progress, and it is suggested that this would provide work for 60,000 persons over a period of two years at a profit to the nation. With regard to electrical development, it is considered that the work to be carried out by 1940, as recommended in the Weir report, should be concentrated into the next five years to give employment to an additional 48,000 men in each of the next two years, and 14,000 additional men in each of the next two years in the electrical machinery industry, apart from the increased employment in the wiring of premises and manufacture and installation of fittings and plant. Extensions, electrification and construction of tube and surface railways are put forward as a means of providing work for 24,000 men for the first two years and 10,000 men for two years more. It is alleged that under the specific proposals made, work would be found for 586,000 men within the first year from the commencement of the schemes and 611,000 within the second year, and a number of minor methods of providing employment would, it is said, bring down the unemployment figure to normal proportions within twelve months of the formation of a Liberal Government. So far as the roads are concerned, it is proposed to raise a loan; the finance in other cases would apparently be provided by the authorities carrying out the scheme, with assistance from the State if necessary. It is emphasised that taxation would not be added to.

The Melchett-Turner Proposals.

On March 12th the "Melchett-Turner" conference of employers' and trade unions' representatives approved an interim report on unemployment. The report which was prepared by a joint committee of members of the conference presents a number of suggestions for alleviating unemployment and cognate recommendations. An emigration programme extending over 20 years is suggested, the necessary funds being raised by loan instead of being paid out of revenue, and under the control of a joint committee of British and Dominions Government representatives. A separate committee of employers and trade unionists should co-ordinate policy. Other suggestions are:—The development of Crown Colonies with a view to orders for equipment being placed in this country; the creation of a development fund for financing schemes of national importance; the carrying out of new constructional works and the speeding-up of existing schemes; adequate pensions for workers attaining the age of 65 who cease work, supplemented by employers where possible; a Government inquiry into currency and banking policy; the pressing forward of "rationalisation" in the widest sense of the term; the raising of the school leaving age, &c. Among other things it is considered that the establishment of better trading relations with Russia would have a beneficial effect upon unemployment in this country.

The Electrical Development Association.

The Annual Dinner, Meeting and Report.

On Thursday last week the annual dinner of the British Electrical Development Association was held at the Piccadilly Hotel. Sir John M. Gatti (president) was in the chair, and among those present were Lady Gatti, Lord Birkenhead, Ald. Sir Duncan Watson, Ald. W. Walker and Mr. Frank Hodges (Central Electricity Board), Sir John R. Brooke, Sir Harry Haward, Mr. W. W. Lackie and Mr. T. P. Wilmshurst (Electricity Commissioners), Sir Herbert E. Morgan, K.B.E., Col. R. E. B. Crompton, Mr. W. H. Walton (president, E.C.A.), Mr. C. H. Merz, Mr. F. Massingberd Rogers, Mr. M. Solomon (chairman, C.M.A.), Mr. W. F. Moir (chairman, E.L.M.A.); Mr. J. W. Beauchamp, and Mr. A. Nichols Moore (president, I.M.E.A.). The gathering included a large number of ladies. The first speaker was Lord Birkenhead, who proposed the toast of the Association. After referring to the pioneer work of Sir John Gatti's father, he said that the object of the Association—spreading the electrical idea without making a profit—was an admirable one. He did not know whether it would be of advantage to this country to exclude foreign capital. He wished that some historical economist could ascertain how much British capital had been invested abroad since the Napoleonic wars, and it would be interesting to know how much was invested abroad at the present time without any discrimination between the British and native investor, and with what results. Capital was cosmopolitan and no attempt should be made to impose conditions which were not encouraging to the further investment of foreign capital. Reverting to the subject of the toast, his Lordship said that the future developments of electricity were illimitable, for hardly one house in six in the existing supply areas was wired for electricity. The others would not be content to remain without it long. The future domestic consumption was incalculable and must progress very rapidly. The economic fortunes of this country during the next ten years would be profoundly influenced and probably ultimately determined by the development of electricity supply.

Sir John Gatti responded, and said that Lord Birkenhead, able to choose among many avenues for his activities, had selected the electrical industry as one in which his great experience would prove of the most value. He went on to say that so far as E.D.A. was concerned it didn't matter where the money came from so long as they got it. If Lord Birkenhead could influence subscriptions they would not inquire too closely as to the source. He quoted two amusing "gas" newspaper items in one of which a gas company claimed that its progress had been equal to that of any other gas company, *viz.*, one per cent. Sir John remarked that the electrical industry was not satisfied with anything less than 10 per cent.

Mr. J. W. Beauchamp, in proposing the health of the guests, appealed to the visitors to tell everybody in their respective spheres of influence about electricity and the Association. The latter carried on the work of the Central Board and the Commissioners from the point at which, by the nature of things, they were compelled to leave off. It was the aim of the Association to build up in the minds of the public a sort of "personality" for the electrical industry. Under modern conditions the personal touch between buyer and seller was disappearing; the electrical industry had to set out to give every consumer a personal interest in electrical service.

Sir Herbert Morgan, K.B.E., responded to the toast. He said that low electricity charges not only benefited the consumer, but were also good for the industry, and concluded by suggesting that the right course to pursue in electricity supply was to estimate the possible consumption in each locality, treat that as an economical unit, and supply energy at a predetermined price.

The Annual Meeting.

On the following day the annual meeting took place at the Hotel Cecil, and Sir John Gatti again presided. After formal business, Mr. A. C. Cramb, chairman of the Executive Committee, presented the Council's report for 1928, which is reviewed below. He drew special attention to a number of items, particularly the reorganisation of the provincial area sub-committees, which, he said, would contribute materially to better results. He pointed out that a number of supply undertakings, although partaking of the advantages of the Association's work, would not pay their share of the cost. The adoption of the report was seconded by Mr. H. C. Lamb, and the motion was carried unanimously.

Mr. R. P. Sloan proposed that Dr. S. Z. de Ferranti, F.R.S., should be elected president for the ensuing year, stating that nobody was more fitted for the position than this pioneer of the electrical world. Mr. C. W. Sully seconded the proposal, which was unanimously adopted.

Mr. H. H. Berry then proposed Capt. J. M. Donaldson as chairman of the Executive Committee; this was seconded by Mr. E. Leete and carried. The meeting concluded with votes of thanks to Sir John Gatti, Mr. Cramb, and others.

The Report for 1928.

Further progress is recorded in the report for the past year. An important part of the Association's work during the year has been the reorganisation of the provincial area sub-committees on a new basis, with a definite constitution and rules as to the election of members, together with the appointment of four officers in four of the eight areas into which the country has been divided. The Association has taken over the Manchester Lighting Service Bureau. At the end of the year area sub-committees were in existence or in process of formation for the following areas: North-East, North Midland, South Wales and Monmouth, North-West, South Midland, and South-West. Steps are being taken to re-establish the Scottish area committee. Twenty-seven supply undertakings joined the Association during the year, while twelve others increased their rate of subscription. With regard to sub-committees, that on Industrial Electric Heating has carried out a great deal of investigation work; a comprehensive paper on the subject prepared by the Committee was read at the Fuel Conference in September last. The Sub-Committee is considering the production of a film demonstrating electric heating processes. Exhibitions were organised at Poplar and Manchester in conjunction with the local electricity supply authorities. Among the work of the Rural and Agricultural Electrification Sub-Committee was the preparation of a paper for inclusion in the report of the Electricity Commissioners' Conference on "Electricity Supply in Rural Areas." It also produced a 3,500-ft. film showing the applications of electricity in rural areas. A conference was organised at the Royal Agricultural Show, Nottingham, last July. The Refrigeration Sub-Committee made an exhaustive inquiry into the suitability of British domestic electrical refrigerators and issued a satisfactory report. A Refrigeration Campaign was held from June 8th to 25th, the cost being met from a special contribution of £1,650 from the refrigerator section of the B.E.A.M.A. Among other things, a special window display was exhibited in 704 showrooms. It is claimed that the campaign was of considerable educational value, and that it increased sales of refrigerators. The Exhibition Advisory Sub-Committee has assisted in the promotion of local exhibitions, and is organising an exhibit at the forthcoming Newcastle exhibition. Displays were arranged at three exhibitions during the year. The Electric Vehicle Committee of Great Britain organised a display of electric vehicles in connection with the C.M.U.A. annual parade. The Committee has arranged that the case for the electric vehicle shall be presented by an independent witness before the Royal Commission on Transport. The report briefly summarises the results of the 1927-28 Circle Campaign, during which lectures and demonstrations were attended by 1,200,000 people and about a quarter of a million pamphlets were circulated. Greater space is given to the Factory and Workshop Lighting Campaign. A total of £7,500 was contributed for the purposes of the Campaign by E.L.M.A., the Electric Light Fittings Association (Industrial Section), the C.M.A., the E.C.A., and the Association itself. The Campaign aroused considerable interest in all parts of the country, and 2,400 inquiries for further information were dealt with. The Campaign is to be followed up during the autumn of this year. For the 1928-29 season, instead of a short-period campaign, it was decided to introduce a special continuous programme of activities, and £12,000 was provided for special propaganda.

A special design for an E.D.A. poster board was circulated, and as a result many undertakings have placed orders for a regular supply of posters. Continued growth in the attendance at E.D.A. conferences is recorded. During the year Mr. G. S. Francis delivered 144 lectures to many kinds of associations and gatherings, the estimated total of the audiences being 10,000. The director and the business manager also delivered a number of lectures in many parts of the country. There was a large demand for lantern slides, and 69 loans of kinematograph films were made. The receipts from the sale of literature (approximately three million pamphlets) amounted to £3,237. The E.D.A. publicity service now includes 128 stock publications and 16 posters dealing with various applications of electricity. The director and business manager represented the Association at various conventions during the year, and the director read papers at two of these. Increasing support is being received from all sections of the Press. The report makes reference to the good work which is being accomplished by the Electrical Association for Women; the total number of branches at the date of the report was 16. The "outlet" campaign has brought this important matter to the attention of large numbers of electrical engineers, builders and architects, and it is planned to extend the campaign during this year.

The accounts show a credit balance of £3,862 for the year, to which is added £4,307 brought forward, making £8,169; it is proposed to transfer £5,000 of this to reserve.

Dielectric Studies.

Electrical insulating papers for the manufacture of power cables; the prevention of ionisation in impregnated paper dielectrics.

AT a meeting of the Institution of Electrical Engineers on March 14th, two papers were read relative to the above subjects, extracts from which follow:—

Cable Insulating Papers.

By T. N. RILEY and T. R SCOTT.

Since cable paper must be applied in layers to secure flexibility, it must have sufficient mechanical strength, both along and across the machine direction of the sheet, to permit of the core being wrapped without undue breakage of paper, and to permit of the cable being bent in service without cracking the paper tapes.

The paper fibres always contain moisture colloidally linked with the cellulose as part of the structure. In the air-conditioned state they also contain a large percentage of free moisture. The "combined" moisture cannot be removed without physical damage to the paper. Manufacture of the paper must be so carried out that the "combined" moisture is kept to a minimum, and the electrical conductivity can be

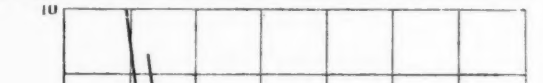


Fig. 1.—Electric-strength Thickness Characteristics of Unimpregnated Paper.

reduced to the lowest possible value by the removal of the whole of the free moisture. The structure must also be such as to facilitate the removal and replacement by oil of all the gas content, both in the pores of the fibres and between them.

It is impracticable to discuss electric strength as a function of the paper alone; but obviously the structure must be such as to result in the highest possible electric strength in combination with the impregnating compound in the finished cable. The paper must also have good ageing qualities, so that there will be no deterioration of the electrical or physical characteristics with time.

Since certain terms with regard to the structure of paper are used somewhat loosely at times, it is necessary to define accurately the meaning of the terms used by the authors. *Bulk* is defined as the ratio of the total volume to the volume of solid content, and is therefore the inverse of "apparent density." *Porosity* is the inverse of fluid resistivity, which may be simply defined as the resistance offered to the passage of a fluid by unit volume of the material (due account being taken of the viscosity of the fluid). *Oil absorption or capillarity* may be defined from two different aspects: (*a*) the force causing flow, and (*b*) the rate of flow. *Mechanical strength* may be defined in several ways, according to the nature of the stress employed, *e.g.* tensile, tearing, bursting, folding, creasing, etc. The first three are of most importance in cable work, and the methods of test are laid down by the Electrical Research Association.

High breakdown voltage may be dependent on the impregnating compound, on the paper, or on the two in conjunction. Its exact value will also depend on the temperature of the sample and on the rate and duration of application of the voltage. The mechanism of failure may also vary with variation of these conditions, but this is still imperfectly understood, and in comparing several types of material for construction we are interested mainly in relative values.

Proposals have also been made from time to time for a cable in which oil alone is employed as a dielectric, the conductor being supported at intervals by special insulator brackets. For cable work such structures have not been successful, and this has usually been due either to surface leakage over the supports, or to breakdown caused by lining up of any impurities in the oil. One function of the paper insulation of a cable is to prevent this lining-up action, and this can be done by employing a paper in which the maximum barrier-action, so-called, is obtained (see Del Mar and Hansen,* also Dawes and Hoover†). From this point of view the compound is the main dielectric, the paper serving mainly to prevent the lining up of any loose particles present, and also acting as a mechanical support with a long leakage surface.

In fig. 1 the dielectric strength of air-conditioned paper is plotted against thickness in curve A. The effect of introducing an artificial pinhole normal to the surface of the paper is shown in curve B, the values of electric strength for a given thickness being appreciably lower. They are actually lower than would be obtained for air alone with the same gap dimensions, as is indicated by the dotted curve founded on the tests of Dubsky. This indicates that the presence of a direct surface leak along the sides of the pinhole reduces the breakdown, as compared with that obtained with the same length of gap of air alone, and still more as compared with the un-

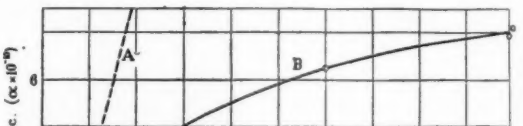

Resistivity of cable dielectric. (α × 10⁻¹⁰)
Resistivity of paper (α × 10⁻¹⁰)
A
B
Curve A: Theoretical, assuming zero gap conductance
B: Experimental

Fig. 2.—Air Resistivity of Cable Insulation as Function of A.R. of Paper.

punctured paper. That the fibres direct will stand higher voltages than are sufficient to cause breakdown along the surface leakage path is also indicated by the effect of drying on the breakdown values of several papers.

It appears clearly that the greatest gain in electric strength is to be obtained by reducing the surface leakage, first by removing every trace of surface moisture, and second by increasing the length of the leakage path. In order to effect improvements in this respect, some means of comparing different papers quantitatively must be devised. For the usual cable-paper structures, any increase of the length of the interfibrous channels will also increase their resistance to the flow of air. This was the basis of Emanueli's suggestion‡ that the electric strength is a function of the porosity (or its inverse—fluid resistivity) of the paper structure, *i.e.* the breakdown strength is increased by the same increase in channel length which gives the paper high fluid resistivity.

The fluid-resistivity value obtained from sheet tests can be applied theoretically to cable structures by use of the normal log. (R/r) formula for cylinders, and practically by considering cylindrical layers of paper each sealed longitudinally, so that the fluid must penetrate each layer as it passes from the outer radius to the central core. Practical measurements in this form agree well with tests made on sheets, except that the spaces between concentric layers constitute regions

* A.I.E.E. *Transactions*, 1922, Vol. 41.
† Ibid., 1926, Vol. 45.
‡ Conference Internationale des Grands Reseaux Electriques, Paris, 1925, Vol. 1.

of low resistance, and the total resistance, therefore, is slightly lower than that indicated by the theoretical formula. If, however, an actual cable sample of equivalent dimensions be examined, the value of the resistance is found to be enormously decreased, the actual reduction in value being a function of the sheet-resistivity value, the method and tightness of lapping, etc. This reduction is obviously due to the laminated tape structure of the cable insulation, this providing paths from sheath to core which do not penetrate fibrous insulation. This structure also brings into play the capillary force due to the narrow channel between the layers, in addition to that due to the fibrous structure of the sheet itself. Fig. 2 illustrates the

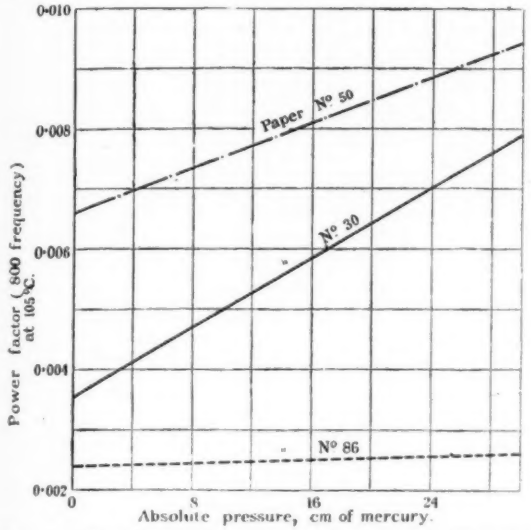


Fig. 3.—Variation of P.F. of Paper with Vacuum during Drying at 105 deg. C.

resistivity value of the core insulation as a function of the paper-sheet resistivity, and also the resistivity of these gaps for one standard type of lapping. In all practical cases of cable impregnation there is a pressure head of oil acting in addition to capillary pressure, and there will be a tendency for the oil to take the paths of least resistance. During impregnation, therefore, the tendency is for the oil to flood these gaps and to isolate the paper tapes, leaving impregnation of the tapes to follow at the rate determined by the structure of the paper. If a sheet of paper at atmospheric pressure be immersed in an oil bath so that the upper and lower surfaces are penetrated simultaneously, a certain volume of air will be trapped and compressed until the pressure built up equals the capillary driving force and equilibrium is reached. If the hydrostatic pressure of the oil be raised so that a pressure is added to the capillary pressure, the air will be further compressed until the required equilibrium pressure is attained. Simultaneously, of course, a certain volume of the air will be dissolved in the oil, owing to the normal higher solubility at increased pressure. On release of the pressure, an approximation to the previous equilibrium will be obtained.

The influence of capillarity on the retention of the impregnating fluid during thermal cycles in service has already been illustrated. The paper structure may, however, exert influence in two other directions. The decrease in bulk of a paper by increase in the cellulose content reduces the volume of the impregnating fluid present, and, in virtue of the low coefficient of expansion of the paper, reduces the thermal expansion effects produced. In an observed case in which two cores of an H-type cable were made up with different papers the oil content in the paper of lower bulk was reduced by 26 per cent., relative to the oil content of the bulky paper.

In general, the number of factors influencing the electrical characteristics is so great that any analysis designed to investigate one particular factor is extremely difficult to make. There is, however, distinct evidence that although in all conditions in which paper is in practical use as an insulator it is nominally in a dry state, its electrical conductivity and electrostatic capacity are still modified by the presence of moisture, and that the variation of moisture content leading to irregular electrical tests is intimately connected with the structure of the paper.

It is known that the fibre walls contain fine pores similar to those which have been studied in fibres used for textile manufacture. In flax, for example, Nodder found them to vary in diameter from 2 μ down to the limit of microscopic size (0.2 μ), and it has been suggested by Hedges that the lowering of vapour pressure over the concave surface of water in such pores would account for the retention of the last traces of water in these materials. Calculations, however, show that in order that the water should not evaporate under the normal cable-drying conditions, the radius of such pores would have to be of the order of 10^{-7} cm, which is less than the dimensions of the hydrogen atom (5×10^{-8} cm). Hence it is improbable that the final traces of moisture are held in this manner. It is possible that the moisture is colloidally adsorbed into the fibre wall, and in this case its removal might be expected to affect the structure of the paper. In this connection it may be observed that raising of the temperature above 105 deg. C. or 110 deg. C., the vacuum of 1 mm. of mercury being maintained, lowers the power factor beyond the values shown in fig. 3, say, but that loss of mechanical strength has always been observed.

"Swollen cellulose" is a colloidal form of cellulose with increased adsorptive power for water and for dyes and certain salts.

Another factor is worthy of note in connection with the colloidal structure. During manufacture, paper comes in contact with many times its own weight of water, and the purity of the water in respect of dissolved salts must affect the purity of the paper. The adsorptive properties of the colloidal cellulose for electrolytic salts must, therefore, be taken into account, but there is little doubt that conductivity values are considerably affected. The amount of such impurities is indicated by the ash content. In the papers considered, freedom from metallic particles as determined by E.R.A. tests can be assumed, but the presence of such particles would, of course, considerably modify the results obtained.

Mechanical strength is a secondary consideration in selecting a type of structure, since in most cases it is comparatively simple to obtain sufficiently high values to meet the various stresses encountered in manufacture, laying and service. Similarly, ageing is a characteristic which should be considered only after the initial requirements have been obtained. It does not appear to be reasonable to build up a structure capable of retaining its qualities for many years if the structure itself is unsuitable and likely to induce breakdown at an early stage in the life of the cable.

Prevention of Ionisation.

By S. G. BROWN and P. A. SPORING.

It has been found that if the power factor of, for example, a high-pressure cable is measured at increasing values of voltage, the measured losses increase rapidly when a certain voltage is exceeded. This potential has been referred to as the "critical" or "ionisation" voltage, and it has been tacitly assumed that as long as the cable is working below this voltage, ionisation of the enclosed air cannot take place.

The assumption is not quite correct; if the dielectric contains only little occluded air, then, since the proportion of air to the remainder of the dielectric is very low, the losses in the air must rise to a very great value before they can be detected by the measuring instruments, which automatically read an average power factor over the whole of the dielectric. The true ionisation voltage may be exceeded many times before any increase in the power factor can, with certainty, be detected.

The history of an unevacuated oiled-paper condenser working on 600 V and 50 cycles is shown graphically in fig. 1. It will be noticed that the power factor and the insulation resistance both show a gradual deterioration. In addition it can be shown that the usual V-shaped curve for the relation between loss and temperature is considerably altered.

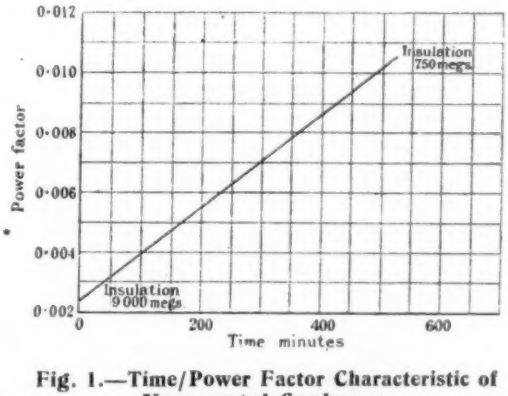


Fig. 1.—Time/Power Factor Characteristic of Unevacuated Condenser.

A further illustration of the effect of ionisation of gas bubbles upon the dielectric is given in fig. 2 which gives the variation of power factor with voltage for an unevacuated oil-impregnated condenser.

Ionisation voltage is not proportional to the dielectric thickness, but rises relatively slowly, so that in order to raise the ionisation voltage to any noticeable extent a very considerable increase in dielectric thickness is necessary.

The inference is that if the dielectric can be arranged in a number of sections electrically in series, the ionisation voltage will be greater than for a plain dielectric of equal thickness.

This conclusion can be tested experimentally, and the results for one particular case are given in fig. 3, in which power-factor/voltage curves for two condensers in series, each of dielectric thickness 1 mil, are compared with those of condensers of 1 mil and 2 mil dielectric thickness respectively.

It appears that if the dielectric contains air it is not possible to prevent ionisation by increasing the dielectric thickness, except to a prohibitive extent. In other words, the absolute potential, rather than the potential gradient, is the deciding factor. It is true that any particular potential difference across a definite distance can be expressed as an average potential gradient, but no real advantage is gained. It is quite impossible to tell from the potential gradient alone whether the dielectric will eventually fail; but it is suggested that, from a knowledge of the absolute potential, this is possible on the above basis.

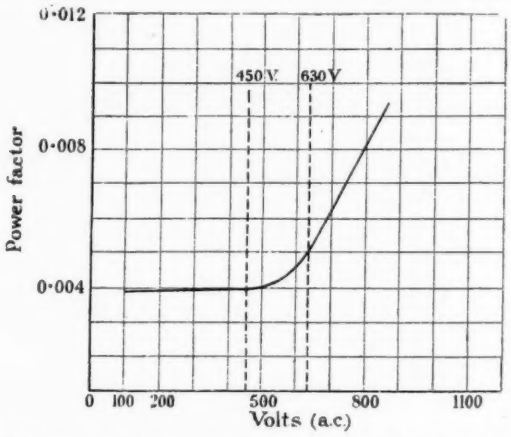


Fig. 2.—Variation of Power Factor with Voltage for Unevacuated Condenser.

The principle on which design is to be based is that ionisation of entrapped air is impossible unless the voltage applied to the electrodes exceeds the minimum sparking potential, which in air at atmospheric pressure is about 300 volts.

The correct method, then, of building a dielectric to work at a given voltage is not to increase the thickness so that ionisation is prevented by that means, since economic considerations render this practically impossible; but rather to arrange that the dielectric consists of such a number of series sections that the voltage across any one section shall not exceed that required for ionisation.

The limiting thickness which may be used for one section will be determined by the puncturing voltage of the thin layers used. The permissible potential gradient will increase indefinitely as the thickness of the dielectric decreases, the voltage remaining constant at 300 volts. Thus the final thickness used will be a compromise, and will be such as to give a reasonable factor of safety in regard to puncture tests.

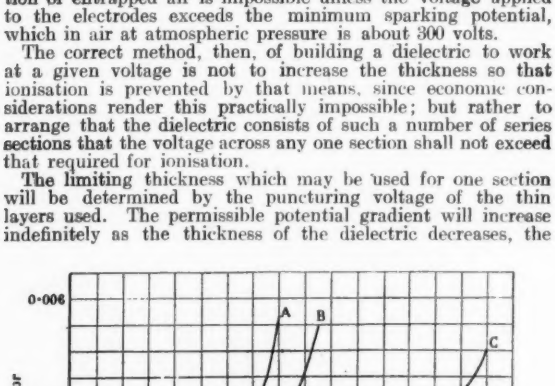


Fig. 3.—Power Factor/Voltage Curves for Condensers in Series.

Breakdown has often been ascribed to the effect of surges. It is interesting to note that although the possibility of puncture by the surges may be remote, yet it is still possible for the surge to be the immediate cause of the breakdown.

The instantaneous breakdown voltage is of value in so far as it discloses actual mechanical defects in construction. On experimental lengths, power-factor/voltage curves, taken with the dielectric impregnated, but not evacuated, give a reliable indication of the performance under working conditions. Obviously, however, this test cannot be applied to any finished product. The test suggested for such a case is that a sample length of cable, or condenser, should be placed in a vacuum, and its power-factor/voltage curve taken under those conditions.

Joint Discussion in London.

Capt. P. Dunsheath, referring to Messrs. Riley and Scott's paper, said he could not support the authors' apparent suggestion that the temperature fall in the power-factor/temperature characteristics (fig. 8 of the paper) was due to moisture. Had the authors considered the possibility of the effect being due to size? He was rather puzzled by the power-factor/temperature curves during various stages of drying (fig. 7), and would have expected a bigger slope at 100 deg C. It was a pity the authors had not given values for different frequencies—such information would have been of more value. Referring to the specific-inductive-capacity/temperature characteristics obtained by the authors, he suggested that if the tests were repeated different results would be obtained, and the difference would probably be due to water content. He could not accept the test in Messrs. Brown and Sporing's paper which involved taking the p.f./voltage curve in a vacuum.

Mr. P. R. Coursey said that Messrs. Riley and Scott appeared to have dismissed calendering as unimportan, but the effect of the process was of great importance. Referring to the suggestion that the power factor could be lowered if the temperature was raised above 105 deg. C., he asked what extent of temperature rise the authors visualised, and what degree of lowering of the power factor was anticipated. He thought that the rise in power factor at the higher temperature was probably due to the chemical structure of the paper. He asked if the s.g. figures were taken by the method of the Electrical Research Association; they appeared to be on the low side. He thought that Messrs. Brown and Sporing must take a pessimistic view in their suggestion that failure took place in a short time. By means of a slide he indicated that failure occurred over a comparatively long time.

Mr. N. A. Allen thought that Messrs. Brown and Sporing's calculations on the dielectric thickness of 1/5th mil for 250 V was unpractical. He roughly calculated that 100 layers of paper would be wanted for 50,000 V. It was no longer necessary to get manila paper in order to ensure good paper. The makers were getting increasingly good results by concentrating on wood pulp. In tests carried out in America 90,000 samples of paper were tried. In the case of manila there was a 20 per cent. reduction in mechanical strength after six months; the figure for wood pulp was greatly below that. Referring to the authors' examples of the effect of the paper density on the current-carrying capacity of the cable, Mr. Allen showed that the increase of carrying capacity of a 0.2-sq. in., 33,000-V cable could be as much as 2,500 kW—a striking achievement.

Mr. H. D. Symonds asked what times the papers were kept at the temperatures referred to. It was difficult to get paper under 1 mil thick that was free from breakdown. He had made six attempts to get paper free from metallic particles, and had only found one that could be tested with a roller and pin at 25 V. Some method was wanted for testing paper in bulk to see if it was entirely free from pin holes.

Mr. T. Barton thought that the paper ought to be tested before filling with compound.

Mr. A. Collins suggested that the ageing test of the E.R.A. in some cases ought to be more severe.

Mr. T. R. Scott, in reply, referred to Capt. Dunsheath's criticism of the p.f. characteristics, and said he could not agree that the results were due to size in the paper; he attributed the results entirely to moisture. He had had experience with size, but there was no difference. In their paper before the Institution last year the authors had given results at three frequencies. Regarding the specific-inductive-capacity/temperature curves, they were too flat to suggest effect from moisture content. He agreed that research was wanted in the absorption in fibres. Calendering was a very wide term which covered most of the processes; the paper referred more particularly to "super calendering." A great deal depended on how calendering was carried out, the temperature, and so on. Some condenser papers had no penetration of oil. Calendering effect in those cases was ruled out. Under vacuum the temperature could be taken up to 105 deg. C. There was no question of cellulose oxidation nowadays. The s.g. figures were taken by the E.R.A. method, but he did not think they were very low. Manila was a trade term applied to white paper; in this country most of the paper which was classed as manila was hemp paper. He did not think that the actual time over which the paper was tested at each temperature was of importance, as the actual p.f. was taken before the test. He agreed that ageing of paper for other than cable papers was of importance.

Mr. P. A. Sporing also replied; referring to Capt. Dunsheath's criticism of the test in vacuum, he pointed out that it was only intended to test a sample piece in that way, and the idea of the vacuum was to get the ionisation voltage. The p.f. of the standard condenser used was that adopted by the National Physical Laboratory. The three condensers compared in the paper were purposely selected as bad examples to show up the defects. Over the past 18 months he had not had one condenser breakdown at 50 cycles.

Referring to Mr. Allen's criticism of the thickness of paper given, he said it was not seriously suggested that cables should be made to those dimensions.

Electricity Measurement.

Recent Developments in Electrical Instruments and Meters for Bulk and General Supplies.

By C. L. LIPMAN, A.M.I.E.E.

(Extracts from a Paper read before the London Branch *of the* Association of Mining Electrical Engineers.)

CONSIDERABLE advances have recently been made in the design and construction of induction-type instruments, with the result that they can now be supplied with an inherent accuracy higher than B.E.S.A. first grade. The following technical particulars relate to a new induction ammeter manufactured under the author's patents and wound for 5 A, 50 cycles. By way of comparison similar data are given for the ordinary shaded-pole type of induction ammeter.

	Nalder-Lipman improved induction ammeter.	Ordinary shaded-pole induction ammeter.
Change of reading for a rise or fall of 1 deg. C. in temperature ...	0.015%	0.4%
Change of reading for a change of 20% up or down in frequency ...	0.4%	12%
Change of reading after being left in circuit for two hours	0.5%	3%
Weight of moving parts	9 gms.	30 gms.
Volt-ampere consumption for full-scale deflection	4	10

The new induction voltmeter and wattmeter possess similar advantages as regards accuracy and construction.

Satisfactory direct-reading power-factor meters of the moving-iron type work on the "alternating-field" (as opposed to the "rotating-field") principle. The distinguishing feature of these phase meters is that owing to their special construction no resultant rotating field is set up, and consequently no "rotational drag torque" upon the moving-iron system is produced, and the disadvantages and errors arising from that torque are eliminated. For important polyphase circuits unbalanced-load-pattern instruments and meters should be specified.

A form of three-phase balanced-load power-factor meter which has gained considerable popularity during the last few years has one current coil and three pressure coils. The readings of this meter are unaffected by variations of the load current, pressure, frequency, temperature, or wave form, within the limits met with in ordinary practice. It enables a saving in the number of current transformers to be effected, and is less disturbed by slight unbalanced loads than would be the case of a balanced-load-pattern power-factor meter having one pressure and three current coils.

Recording instruments have been specially adapted for fitting to electric trains, and a special system of cradle mounting has been devised which protects the instruments from the effects of excessive vibration. These recorders give valuable information, and tend to promote the efficient and economical running of trains. Tapping mechanism by which the chart is linked at regular intervals consists of a short length of fine tube fixed to the end of the pen arm, one end of which moves in a trough, at the back of which is an inking pad; the other end taps on the chart at regular intervals, generally a quarter or half minute, and is depressed on to it by a bar actuated by an electro-magnet, thus (simultaneously) causing the ink to flow in the tube from the pad and making a dot on the chart. If the time intervals are sufficiently short, the record differs little from a continuous line. The advantage of this method of inking is that the pen is not continuously in contact with the chart, and thus "pen to paper friction" is eliminated.

For the purpose of the registration of total kilovolt-ampere hours several methods have been devised, most of which are, however, of an approximate nature. The torque of the induction type a.c. meter changes with the power factor, according to a sine function. As a result, the torque is practically constant in the neighbourhood of the power factor at which it is a maximum. The instrument registers the kVA-hours with a relatively small error, irrespective of the power factor. By suitable choice of the displacement between the active shunt flux and the impressed voltage, the maximum value of the torque can be arranged to occur approximately in the middle of the power-factor range for which the instrument is designed. These meters are, therefore, only suitable for a fixed range of power factor.

A recent development of kVA-hour meter is the "trivector" meter, in which an integration of kVA-hours is obtained by a mechanical combination of an energy meter with a reactive meter, and is suitable for use over a wide range of power factor and voltage. In another interesting construction of kVA-hour meter the revolutions of the two meter rotors are transmitted to a suspended sphere. A floating gear is arranged to take the drive off the sphere at the point where the peripheral speed is greatest, and the drive is transmitted to the maximum demand indicator mechanism, which records the maximum demand in intervals of 15 or 30 min., both in kW and kVA.

The type of meter adopted for the metering of bulk supplies depends largely on the tariff which is selected for the supply. The usual form of tariff for a supply of this nature is one which includes a term proportional to the maximum demand on the system. Taking kilowatt maximum demand as the first example, the usual induction meter is used, together with a Merz-type maximum-demand indicator. The maximum demand is averaged over a certain definite period, which is controlled by a contactor that may be either self-contained with the meter, or separate. As an alternative an averaging recorder is available. When the maximum demand is required to be in kVA, separate kVA and maximum-demand indicators must be employed, or, as an alternative, the "trivector" type of meter can be used. The latter incorporates both kilowatt and kVA record.

Sometimes two or more feeders are used, and the load from each of these feeders has to be summated in order that a true maximum demand may be obtained. If the several circuits are supplied from a common voltage, then the secondaries of the current transformers are often connected in parallel with the current coils of the meter, the latter, of course, being wound suitable for the sum of the secondary currents. A better solution of this problem is to use meters compounded on to a common spindle. Four-element meters have been specially developed for this purpose. They integrate the total energy and simultaneously indicate the combined maximum demand in two or more independent circuits.

Some time ago the author considered the problem of straight-through metering on extra-high-voltage systems with primary currents as low as 10 amperes, in conjunction with Messrs. Nalder Brothers and Thompson, Ltd., and Messrs. A. Reyrolle & Co., and we concluded our investigations with the development of a new series of highly efficient low volt-ampere consumption instruments, including ammeters, wattmeters, power-factor meters, and protective relays, the current windings of which were made suitable for a secondary current of 0.5 A instead of the usual 5 A. This recommendation has now been approved by the Central Electricity Board for the British "Grid." The advantages arising from 0.5 A as full-load secondary current, instead of 5 A, are manifold. The 0.5 A metering improves the performance of the bushing transformer, permitting a finer turn adjustment; it reduces the secondary burden; it reduces the losses in the long run of connecting leads; it enables accurate measurements to be carried out in the usual manner on e.h.p. systems; and it has led to the development of a new and improved series of instruments, requiring very small power consumption and exerting exceptionally large working forces, control springs of normal strength being employed. In order to keep the size and weight of the low-ampere-turns bushing transformers within reasonable limits, it is further recommended to make the magnetic cores of such transformers of metal laminations.

Discussion.

Mr. J. A. B. Horsley expressed the view that for colliery purposes very much more use should be made of chart recording instruments. The author of the paper had not referred specifically to recording leakage indicators, but obviously the principles described were equally applicable to that form of instrument. Generally there was some form of leakage indicator in use at a colliery, but it was of very little practical value, because the main purpose of a leakage indicator was to enable the operator to obtain a continuous record of the state of the installation, and that could be obtained only by means of a chart form of instrument.

Mr. C. S. Buyers, referring to the author's statement that in the ordinary shaded-pole induction ammeter the change of reading for a rise or fall of 1 deg. C. was 0.4 per cent., asked if that meant that if there were a rise in temperature to the extent of 20 deg. C. the change of reading would be 8 per cent. Referring to the author's statement that the change of reading after the instrument had been left in circuit for two hours was 3 per cent., he said that an ammeter was left in circuit practically continuously. The author's remarks with regard to the use of power-factor meters of the unbalanced type, as against the balanced type, had puzzled him, and he asked whether an unbalanced-load power-factor meter should be used in, say, the circuit of a rotary convertor or a synchronous motor, where apparently the load was balanced. The unbalanced type of instrument was the much more difficult to

connect up correctly. The problem of tariffs was extremely involved; each supply authority appeared to have a separate tariff of its own, especially where power factor was taken into consideration and a kVA maximum demand meter was used. Dealing with the problem of summation metering, he said that some consumers had both a.c. and d.c. supplies. He did not know if a charge were made on the maximum-demand basis in both cases, but he gathered it was not possible to have a summation meter which would give the true maximum demand of the two different systems.

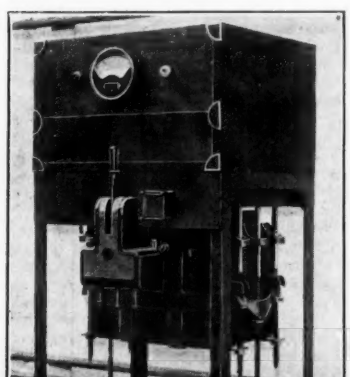
The Chairman, Capt. A. C. Sparks, said that he had avoided using a power-factor meter wherever possible, but in view of the improvements effected, as indicated by the paper, the position appeared to be a little more hopeful, and he hoped to follow up that matter. In some cases there was a tendency for manufacturers to economise in connection with the clocks, in order to secure an order, thus detracting from the value of the instruments. Unless good clocks were used there was danger that one could not take full advantage of the increased accuracy of the instruments themselves. In cases of more than one clock being used there was great difficulty in dealing with the diagrams unless all the clocks were quite accurate. With regard to summation metering, he asked how the author would deal with the proposition of measuring the summation of two demands at a considerable distance—perhaps a mile apart.

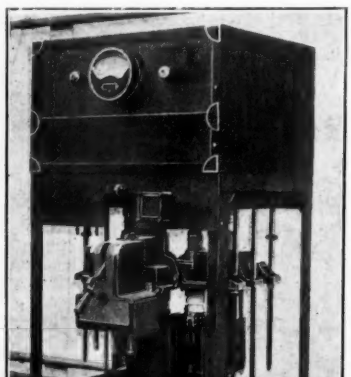
Mr. Lipman, replying to the discussion, apologised for having omitted to mention the recording leakage indicator, and said one could not over-emphasise the importance of keeping continuous records in collieries. He claimed to have been the first to introduce a first-grade induction ammeter. With regard to the errors in the shaded-pole induction ammeter, he said that if an instrument were cold in the first place, and the current was then switched on, the reading would fall gradually, due to the heating up. In the case of the induction-type of instrument, the 3 per cent. error was entirely eliminated by the calibration. With regard to the use of unbalanced or balanced power-factor meters, a rotary convertor was usually perfectly balanced, and the use of a balanced meter was justified; but for power circuits generally he recommended the unbalanced type of instrument. The connecting of the unbalanced meter was a little more difficult than the connecting of the balanced meter, because in the former case the number of terminals was greater. He knew of a good many engineers who did not know what was the sequence of phases in their stations. On occasions he had found that the phase rotation was opposite to what they had thought it was, and if they had used phase-rotation indicators they would not have been in that position. With regard to the changing of recording charts, he had intended to emphasise that if one used instruments which did not give a continuous record, but which were used for short periods at intervals, one might get wrong results, due to surges occurring at the time the instruments were used, whereas by means of instruments which gave continuous records one knew what the conditions were at all times. He suggested that for summation metering for both a.c. and d.c. supplies, the method of the future would be to convert the a.c. quantities to correspondingly proportional d.c. voltages or currents, and then add up the latter by means of ordinary d.c. meters.

Further Vertical Switchgear.

Some Particulars of Drop-down Oil-immersed Circuit-breakers made by Erskine, Heap & Co., Ltd.

That a considerable measure of interest is being evinced in improved types of switchgear construction just now is indicated by the several descriptive articles recently published.* In this connection it is recalled that Erskine, Heap & Co., Ltd., who claim to be amongst the originators of the vertical drop-down isolation feature, obtained letters patent covering that principle in the year 1910. Originally they embodied that method of isolating in low-pressure and 3,300-volt gear, but extended it some years ago to switches for up to 12,000 volts, and the accompanying illustrations actually show a 12,000-volt circuit breaker rated to rupture 150,000 kVA and having a carrying capacity of 500 amperes, the switch needing 23 gallons of oil.





Figs. 1 and 2.—Vertical Drop-down 12,000-V, 500-A Oil Switch.

About space economy there does not appear to be any divergence of opinion: in the case illustrated, the depth from back to front is 2 ft. 7 in., with an additional 10 in. for the maximum projection of the handle, the overall width being 3 ft. 4 in. While overall height is of importance, it is not as important as the width and depth, because a sub-station must at least be of sufficient height to allow an attendant to enter, and it is not a particular advantage to kneel in order to operate a circuit breaker in comfort. The raising and lowering mechanism is an integral part of the gear, so that a separate carriage for lowering the breaker is not required; the one set of mechanism serves the dual purpose of lowering and isolating the main circuit breaker and of lowering the oil tank (generally, when full, the latter is about 40 per cent. of the weight of the complete circuit breaker). The breaker is safely isolated before there is any possibility of an attendant touching any "live" parts, both the isolating and tank lowering being operated by means of a single handle which functions in the following manner:—The first movement causes the switch to open in the event of it having been left closed; further movement causes the switch to be withdrawn bodily from the isolating contacts, and when the movement is continued the tank is lowered, so as to expose the contacts, &c., for inspection.

When the switch is in this position, it can be operated to make sure that renewed sparking contacts, &c., which may have been required, are in working order before the switch is again placed in circuit. A further interlock prevents, if the switch is left in the "on" position when an attempt is made to put it back into circuit, any parts making contact until the switch has been placed in the "off" position. An additional advantage is that as the isolating contacts are not completely encased with insulation, it is possible for the operator, after the switch body has been lowered to the correct position for examination, to see that it is actually disconnected from "live" parts before beginning any examination, or repairs, an additional safeguard being the interposition of an insulated shutter between the "live" and the "dead" parts.

The oil-immersed circuit breaker itself is of recent design on the lines laid down in the latest B.E.S.A. specifications, and similar sizes are interchangeable; being vermin proof, they are particularly suitable for use in tropical countries. The contacts are of the wedge-and-finger type and are easily renewable. All the operating mechanism is contained below the main top plate of the breaker, efficient vents being so arranged that the gasses can be conducted clear of the switch in any desired direction. The main top plate and tank have been given special consideration to render them safe under short-circuit conditions.

The operating lever embodies the Erskine Heap standard true free-handle mechanism and, in addition, is so arranged that a quick break is obtained quite independently of the speed at which the oil-switch handle is operated, while the transformer-operated overload coils are fitted in front and are therefore quite accessible. The normal construction of these sub-station switches does not include compound-filled bus-bar chambers, but they can be easily arranged for, if required.

* Electrical Review, June 15th, 1928, p. 1044; December 14th, 1928, pp. 1011, 1013 and 1017; also February 8th, 1929, p. 256.

Electric Water Heating.

The Sixth and Last E.D.A. Salesmanship Conference of the Session.

On March 15th, the last E.D.A. Conference of the session was held at the Royal Society of Arts. The chair was taken by Mr. P. F. Crinks (Metro-Vick Supplies, Ltd.), and the author of the paper was Mr. M. O. F. England (Messrs. Benham & Sons, Ltd.).

Mr. England confined himself more particularly to hot-water supply apparatus. He pointed out that electrically-heated water boilers could not only be arranged to supply all the hot water required in a system, but could be used if necessary to supplement other methods. Humidification could also be carried out electrically. Other applications were sterilisers and the prevention of freezing in large tanks, a thermostat being installed in connection with the apparatus. A more unusual application of electric water heating was for what was known as continuous bathing, a process used for soothing mental patients in asylums, the heated water entering at the foot of the bath and returning at the head. A bottle containing a 2-kW immersion-type element was situated at the end of, and below, the bath, the thermostat lying parallel with the flow, the water in this way being kept at a constant temperature. Then there were the electric geyser and the electric storage cylinder, and electrically-heated water for the purposes of steam cooking. Apart from purely domestic water boilers, there were the non-pressure and the pressure types of boilers used for restaurants and tea-rooms. In the former, the water was boiled electrically either by clamped-on or immersion types of elements, whilst in the pressure type of boiler the elements were usually immersed. Owing to the beneficial effect of a water heating load upon central stations, it was urged that the aim should be to encourage water heating in off-peak periods, and it was further suggested that calculations, at least for large buildings, must be based upon a charge of ½d. per kWh. At such a charge, the prospects were undoubtedly good because the consumer gained not so much from the relative cost of electricity and other fuels, but from the all-round advantages. For instance, space was saved; in a certain London building, £2,000 per annum was saved on account of the relatively small amount of space required. Modern electric boiler plants ran without attention, effecting a great saving in wages, whilst the efficiency of such plants was between 85 and 90 per cent., if the surfaces were properly lagged and thermostatic control was adopted. Storage cylinders, of the non-circulating type, had an efficiency of 95 per cent., if the draw-off pipes were short, and they were specially suitable for off-peak periods. High-voltage boilers had been developed, principally for high loadings, and were suitable only for a.c. systems. With these boilers, there were no elements, the water inside the boiler acting as a resistance through which current passed direct from the mains. Heat regulation was a comparatively simple matter, although the necessary relays were rather complicated. With large units containing wire elements, the problem of automatic control was greater. The electrode type of boiler had been made as a three-phase boiler up to 6,600-kW capacity. It could operate on pressures up to 16,000 V. or down to 500 V. Another kind of off-peak load was being developed in connection with the heating of individual radiators, in which a mass of material or a quantity of water was heated, the heat absorbed being allowed to dissipate itself, under control, when the current was switched off.

Mr. England then gave some explanation of the various types of apparatus for controlling "off-peak" water heating. The most common form of apparatus was the time switch and reference was made to a type of time switch in which the main spring was wound electrically. Another type mentioned was driven by a synchronous motor. Mention was also made of Mr. G. Wilkinson's "change-circuit" method, the aim of which was to supply water heating loads entirely automatically without load jumps of any kind. Mr. England said that Dr. Ferranti had made a special study of automatically-controlled domestic water heating loads, the aim being to control each house separately by local apparatus so that by maintaining a reasonably steady load per house, the load factor in the network could be improved. In principle, the scheme was to cut off water-heating circuits when the current taken by other circuits reached a pre-determined value. The levelling devices were cheap to install, and metering was simple. Mr. Wilson, Ashford, had developed a scheme of automatic water-heating control in individual houses. By means of pilot-wire control and house relays, he caused the water-heating circuits to be switched off when the street lighting came on. A similar system was in operation in Southend, which only differed in detail. In the "M.O.F.E." system of pilot wire control a current transformer was fitted at the power station having a two-way switch arrangement controlled by the current in the main bus-bar. Alternating current at a low potential was conveyed by two pilot wires to the customer who had a mercury relay switch. The station transmitter was adjusted to cut off the energy at a pre-determined current. Mr. England said he believed that in San Francisco a carrier wave was used to control certain street-lighting circuits. Mr. England dealt in some detail with the technical details of various types of thermostats and said that with a two-wire control the thermostat acted as a switch to excite the coils of either a relay switch or a contactor, the thermostat current flowing until its switch, owing to change of temperature, de-energised the coil of the relay or contactor. With the three-wire control, a relay switch was controlled by the thermostat in such a way that the current passing through the thermostat at functioning point, flowed only momentarily; further, the current was never broken at the thermostat but in the mechanism of the relay. In some bi-metal types of two-wire control thermostats, the contacts were broken with a parting of only 1/10,000th inch, the temperature interval being determined by the length of the expansion element. Three-wire control instruments had a "magnifying" system of levers ranging from 1/100th inch to 1/1,000th inch. There were also other types of two-wire instruments in which expanding liquids were used, and there were quick make-and-break gaps of ½ in. or more; these were capable of carrying several amperes for controlling the heating circuit. A more unusual type of relay switch control was operated by an electric motor. The speaker said that he had carried out experiments with thermostats operating rockers having ball bearing rolling contact guide rails, but had found that the balls were apt to weld or stick. Thermostats were invariably more satisfactory on a.c. circuits since the arc was broken at zero potential. With regard to breaking circuits in general, the rule for a.c. was to have a short and slow break, whilst with d.c. it was best to have a quick and long break. Speaking of elements, Mr. England said that he himself preferred a sound non-withdrawable type but the elements generally were not large enough. He preferred elements of 30-kW capacity, since a number of small units were unnecessary where a job might run into 200 kW or more. With small elements, there were too many fuses and their heat losses and those of the numerous pilot lamps had to be taken into consideration.

Discussion.

Opening the discussion, Mr. G. Nobbs said that enormous progress had been made in the last few years. He would like to hear some experiences with some of the very large boilers that had been referred to.

Mr. C. H. Rayner (Manchester), thought that the paper was too technical and said very little about salesmanship. He considered that thermostatic control was not necessary with domestic water heating appliances. One of the secrets of successful electric water heating was suitable lagging. Thermostatic control was certainly necessary with large installations, and architects should be encouraged to install large boilers in big buildings and take a supply of electricity at a low figure at night.

Mr. Edinburgh (North Metropolitan Electric Power Supply Co.), urged the need for closer co-operation between the supply authorities and manufacturers, in order that an efficient range of apparatus might be produced at a suitable price to meet domestic requirements. The time was ripe for the formation of a joint committee to consider this subject. There was room for a certain degree of standardisation. Apparatus was required for from 5 to 20 gal. with a loading not exceeding 1 kW suitably controlled by some bi-metal type of thermostat. A booster element was also necessary, not, perhaps, as a standard, but for those people who desired it for the purpose of getting a number of baths from, say, a 20-gal. boiler. He suggested that the E.D.A. should take the first steps in the matter.

Mr. Bryan (St. Pancras), spoke of the success of the lagged storage cylinder up to 30-gal. capacity in private houses, and also of apparatus for raising the temperature of water quickly for industrial purposes. In film washing, the electrically-heated geyser had proved to be the solution of the problem of varying the temperature in a manner which was impossible with the storage system. Heating water to a very high temperature for domestic purposes was quite wrong, owing to radiation losses; a lower temperature was ample for all ordinary domestic purposes. Electric water heating was one of the most lucrative and attractive branches for the electricity supply industry.

Mr. Jacobi said that in order to be competitive on price of fuel, electricity for hot water heating would have to be supplied at 0.2d. per kWh with coal or coke at 52s. per ton. In order to supply at very low figures, the energy must be supplied at off-peak periods and the storage system must be adopted. In these circumstances he believed many supply authorities were prepared to supply at 0.2d. or 0.3d. per kWh.

Mr. Honey (Croydon), said that during the cold spell, the contractors and the supply authority in Croydon made such

sales of heating apparatus that the demand on one sub-station went up by 120 per cent. With electricity at ¼d. per kWh or less, it was possible to compete with 500-B.th.u. gas at 3s. per thousand for water heating. At Croydon they had specialised on the storage type of apparatus, having a capacity varying from 1½ to 33 gal. A thousand apparatus having a maximum demand of 800 kW had been connected to the mains with thermostatic control. A special night tariff of ½d. per kWh between 11 p.m. and 7 a.m. was in force, the hire charge being £2 8s. 6d. per quarter, with a rebate to the consumer if he had not used the maximum amount of energy. This charge covered hire of heater, time switch, separate meter and the total number of kWh that could be used during the eight hours. That had not taken on so well as had been hoped, but it was because builders were erecting houses with such small accommodation that a 33-gal. tank could not be fitted in. He asked for experience of the night tariff system elsewhere, and also of immersion heaters in tanks about which not much had been heard in the London area. At Croydon 2,000,000 kWh per annum was supplied for water heating out of a total of 34,000,000 kWh with 30,000 consumers, but he did not think saturation point had been reached yet.

Mr. G. C. Allingham said the ordinary householder should have it impressed upon him that there were advantages in electric heating other than that of price alone.

Mr. Selly (St. Marylebone), said that with electricity at 0.3d. per kWh they had found that to raise 1,000 gallons of London tap water per day to 150 deg. F. throughout the year —the figures were the average of the years 1922-23-24—cost roughly 7s. 1d. or 1d. for 10 gallons; with electricity at 0.375d. per kWh the cost worked out at 8s. 9.37d., whilst with electricity at 0.5d. per kWh the cost would be 11s. 8d. per day. It was therefore advisable to adopt the storage system for domestic purposes, using thermostats and sufficient storage and taking advantage of night tariffs. There was a danger of looking at the problem from the wrong angle when making comparisons with coke-fired boilers, because with electricity used in the manner he had suggested, there was a constant supply of hot water at a constant temperature and no mess, to say nothing of the saving in floor space and simplicity of operation.

Mr. Ayres emphasising the point that the mere question of cost must not be taken into account when considering water heating by various methods, mentioned the case of a hospital where, on the question of fuel cost alone, it would have been necessary for the energy to be supplied at 0.18d. per kWh, which, of course, was impossible. Taking into account, however cleanliness, convenience, &c., there were actual savings which could not be measured in terms of money, and the electrical installation was preferred.

Mr. England briefly replied to the comments.

Mr. P. F. Crinks, chairman, in proposing a vote of thanks to the author, wished that in the discussions not quite so much was made of the troubles of the central station in relation to these new types of load. The object of those concerned with selling was to sell as much electricity as possible and let the station men solve the difficulties that might be involved.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Lead-melting Furnace.

In order to meet the demand for a highly efficient furnace especially suited to the peculiar needs of accumulator makers, Sir W. G. Armstrong-Whitworth & Co., Ltd., have introduced the "Monometer" patent ladling furnace, fig. 1. This furnace has a capacity of 2 tons, and is equipped with four ladling positions, each of which is separated by cast-iron sections in order to prevent poisonous fumes or waste gases entering the work room. The design has been specially prepared with a view to ensuring uniform and continuous melting, and that this has been successfully accomplished is evidenced by the claim that cold pig metal up to 250 lb. at a time can be added without lowering the temperature at which the furnace is operating. The furnace is gas fired by means of "Monometer" atmospheric siphon-type burners, which operate without fans or blowers, no added air pressure being required. A very fine control of temperature, it is claimed, is secured by this system. Alternatively, the furnace may be fired with "Monometer" low-pressure oil burners; the air pressure required in this case is approximately 1 lb. per sq. in. All waste heat and spent gases pass, by way of elongated slots in the flange supporting the iron crucible, into an upper chamber, where they form a reducing atmosphere, which is of the utmost importance in preventing oxidisation of the metal, and at the same time enabling the calorific value of the fuel to be utilised to the utmost extent. The body of the furnace is constructed of cast-iron, and is very rigidly built to withstand rough foundry use. It is portable, self-contained, except for the fuel connection in gas-fired types, and requires no special foundation. The iron crucible or pot is made of a special tantalum alloy to resist the action of both heat and molten metal. The furnace is designed to operate continuously 24 hours a day for long periods, with practically no attention.

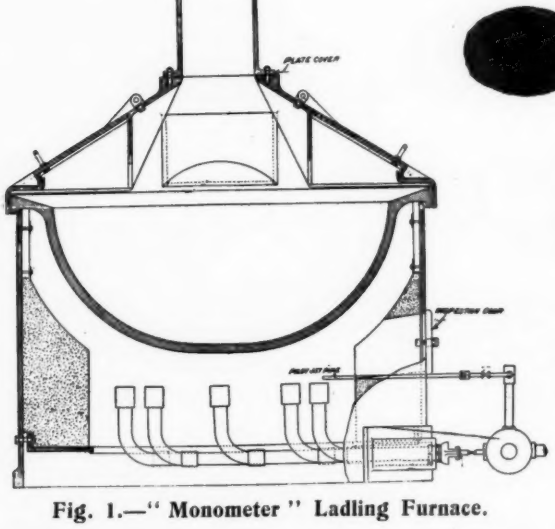


Fig. 1.—"Monometer" Ladling Furnace.

The "Runbaken" Unbreakable Hydrometer.

A handy device for use in connection with battery-charging has been received from the Runbaken Magneto Co., Tipping Street, Ardwick, Manchester. It is a hydrometer (fig. 2) produced in a transparent "unbreakable" material, and a perforated disk is fitted through which the shaft of the float passes, keeping the latter in a central position. The float itself is coloured in sections and not only indicates the s.g. of the acid, but also the state of charge at a glance. A long rigid nozzle is provided which enables acid to be drawn up, even if it is at a low level in the accumulator. Two sizes are made; one is a pocket model supplied in a convenient leatherette case, while the other is a larger one intended for garage use.

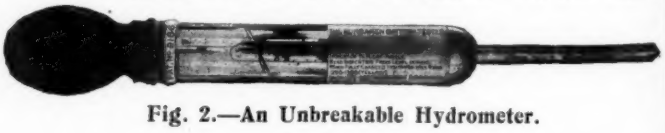


Fig. 2.—An Unbreakable Hydrometer.

An Air-disinfecting Device.

A scientific method of freshening and purifying the air in places of amusement is by means of the "Oxygen Rotor," which has been introduced in this country by Major Frank Small, M.I.Mech.E., and is being developed by the Sentry Safety Control Syndicate, Ltd., 132, Wardour Street, W.1. The rotor, fig. 3, consists of a torpedo-shaped aluminium body, containing a ½-h.p. electric motor, which propels the machine by means of a small air screw at the rear. Panels for advertisements are fitted on both sides, and are illuminated from within by electric lamps controlled by a flasher for colour-changing and other effects. The lower part contains a storage tank for scent, which is withdrawn and discharged in a finely-atomised spray by means of oxygen gas fed through a flexible tube incorporated in the suspension cable. The whole machine is supported from the roof by a special cable fitted at its lower end with a swivel, so that it is free to rotate without twisting the cable. The swivel is provided with slip rings and brushes for the lighting and power circuits, and also with a central duct and gland for the oxygen supply. The weight is carried by duplicate steel wire ropes which, together with the electric leads and oxygen tube, are formed into a cable and covered with braiding. Through a special system of sheaves, guides,

and so on, haulage is done by an electrically-driven winch in the roof, fig. 4. The electrical controls have been specially designed to secure the greatest possible safety in operation, and to comply with the stringent requirements of the authorities. Automatic switches A and B, fig. 4, are fitted on the channel guides, and operated by a striker on the travelling crosshead to prevent the machine from being raised or lowered beyond certain fixed points, their operation being shown by neon pilot lamps on the control board. The switch A has an extra set of contacts connected in the rotor motor circuit, so that it cannot be started until the machine is lowered away from the ceiling. As the machine has to be lowered to the floor from time to time for refilling with

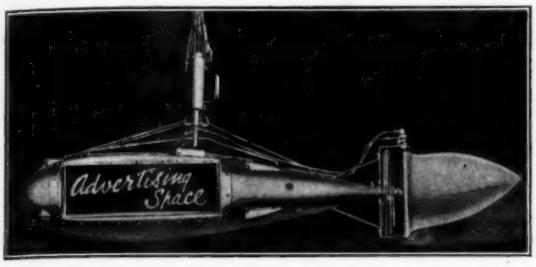


Fig. 3.—The " Oxygen Rotor."

scent, a switch is provided on the control board to re-establish the circuit broken by the limit switch B, and this can only be operated by using a key. Speed control being essential, motors of the universal type are used on the rotor, a resistance or choke coil being inserted in circuit and adjusted on site to suit local conditions and limit the circular path of the machine to a certain maximum diameter. A push-button switch, which has to be held in, permits of a section of the resistance or choke coil being cut out temporarily in order to drive the machine out to its full circle as quickly as possible. As the machine is only used during intervals between acts, it is desirable that it should be brought into and out of action quickly, and provision has therefore been made for reversing

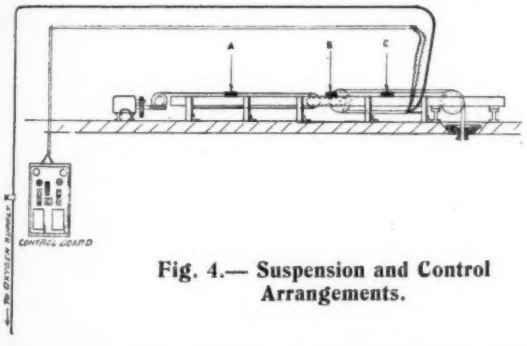


Fig. 4.— Suspension and Control Arrangements.

the propeller. By this means it is brought practically to rest in the centre within twenty seconds, whereas under the action of gravity alone the time would be over two and a half minutes. We are indebted for the above particulars to Captain A. W. Empson, A.M.I.E.E., who, as technical adviser in connection with the production of the apparatus, designed the controls and lay-out and supervised the installation.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Railway Electrical Systems.

On March 11th, Commander BELLAIRS asked the Minister of Transport whether he was aware that on the amalgamation of railways conversion schemes had to be entered on owing to different electrical systems having been previously adopted; and whether the electrical systems on the Southern and Great Western Railways were such as to obviate any such difficulty in the future.

Colonel ASHLEY said he was aware that the constituent railways of the Southern group were not electrified on the same system, and that the company had found it desirable to alter the system on certain sections. As regarded the future, the general question had recently been exhaustively reviewed by the Railway Electrification Committee (1927).

Electricity Board Tariffs.

Mr. KELLY asked what were the areas for which the Central Electricity Board had fixed tariffs of charge.

Colonel ASHLEY replied that no tariffs had yet been fixed for any area.

The Control of Copper.

On March 12th, Mr. HANNON (U.) asked if the President of the Board of Trade could make a statement showing the stocks of electrolytic or other copper in this country at the end of 1925 and last year, respectively; whether the Government was satisfied that adequate supplies were available in the event of national emergency; and whether, in view of the foreign control of copper production, which had led to a large rise in prices, the Government was prepared to encourage firms in this country to undertake the smelting and refining of copper.

Sir P. CUNLIFFE-LISTER said that the London Metal Exchange figures of stocks in public warehouses showed 56,047 tons at the end of 1925, and 6,801 tons at the end of last year. He had no information with regard to private stocks. The position with regard to prices and stocks was being watched.

The G.E.C. Share Issue.

On March 14th, Col. WEDGWOOD (Lab.) asked the President of the Board of Trade whether any countries placed obstacles in the way of the investment of British capital in public companies registered in those countries.

Sir P. CUNLIFFE-LISTER replied that a number of countries had regulations governing the investment of foreign capital, but considerable inquiry would be necessary before a complete list could be given.

Col. WEDGWOOD asked if the President of the Board of Trade would take steps to prevent discrimination here, which was injurious to this country's reputation in the capital markets of the world, and was likely to produce ill-feeling, such as had recently been perpetrated.

Sir P. CUNLIFFE-LISTER considered that the matter could not be suitably dealt with by legislation. Further asked if he approved of what had taken place, Sir Philip said that it was very desirable that as much capital as possible should come into this country from all sources.

Jarrow and District Electric Traction Co.'s Bill.

Consideration of this Bill was commenced by a Select Committee of the House of Lords on March 11th. The Bill provides for the substitution by the company of motor omnibus services for the tramway between Jarrow and South Shields. There was opposition from the Durham County Council, the South Shields and Jarrow Corporations and the London and North-Eastern Railway Co. The company sought protection from competition on the route, and this was objected to by Jarrow and South Shields as giving the company a monopoly. Evidence was given that in 1926 the two Corporations had refused to exercise their right of purchasing the company's undertaking.

The Loch Doon Hydro-Electric Scheme.

A Committee of the House of Lords on March 12th approved a Bill providing for the production of electricity by the damming of Loch Doon, &c. Sir JOHN SNELL, chairman of the Electricity Commission, gave evidence in support of the scheme, stating that it would be of great advantage to the national " grid " connection between England and Scotland.

Legal.

Welding Machine Patent Appeal.

THE Court of Appeal, consisting of the Master of the Rolls and Lords Justices Lawrence and Russell, on March 12th delivered its reserved judgment upon the appeal of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., from the judgment of Mr. Justice Eve in the Chancery Division, holding that they had infringed the letters patent of the plaintiffs, the Rose Street Foundry & Engineering Co., Ltd., for a welding machine. The hearing of the appeal was reported in our issue of February 8th (p. 262). It was alleged by the plaintiffs that the defendants had caused to be altered a manually-operated butt-welding machine so that it infringed their patent covering the automatic control of the welding operation.

The defendants pleaded that the plaintiffs' invention was insufficiently described in their specification, and alleged that it had been anticipated by prior publication, public work and prior common general knowledge. They also denied infringement.

The MASTER OF THE ROLLS, in the course of a long written judgment, said that in his opinion the plaintiffs' specification was too ambiguous to be allowed to be good, and they had failed to establish the validity of their patent. There were other points on which the defendants relied, such as prior publication. In the view he had taken it was not necessary to give any decision on that point, but holding as he did that the invention was claimed to apply to " spot " as well as " butt " welding, there were grounds for holding that prior publication would be a grave difficulty in the plaintiffs' path

to establish the patent. The appeal would therefore be allowed with costs and the order of Mr. Justice Eve discharged and the action dismissed with costs.

Lords Justices Lawrence and Russell delivered judgments to the same effect.

British Electrical Instruments, Ltd., v. Super Radio Co.

In the Manchester Chancery Court on March 11th the plaintiffs asked for an injunction restraining the defendants from using the plaintiffs' name or initials, and from representing themselves to be connected with the plaintiffs.

The solicitor for the defendants said that they submitted to judgment. The Vice-Chancellor accordingly made an order, with costs, and directed an inquiry as to damages.

British Engineering Products Co. v. British Electric Plant Co., Ltd.

In the Court of Session, Edinburgh, last week, judgment was pronounced by Lord Fleming in an action by the British Engineering Products Co., Victoria Street, S.W.1, and C. L. Brown, the sole proprietor, against the British Electric Plant Co., Ltd., Alloa, for payment of two sums of £70 and £900 respectively as damages in respect of an alleged breach of contract. In March, 1923, the parties entered into an agreement under which the plaintiffs were to act as agents for the sale of the respondents' manufactures for a period of three years within an area comprising the county of Monmouth and part of the county of Glamorgan. The plaintiffs appointed a Mr. Dunbar to act as their district engineer, and he so acted until January, 1924, with satisfaction to both parties. The plaintiffs appointed a successor, and from the outset the respondents were dissatisfied with the arrangement made, and on April 30th, 1924, definitely repudiated the agreement. The present action was not raised until April 10th, 1928, nearly four years after the termination of the agreement.

Lord Fleming assoilzied the respondents. He said that the ground upon which the respondents maintained that they were entitled to rescind the contract was that the plaintiffs had failed to maintain a branch office and district engineer in the district. The plaintiffs had notice at the beginning of January, 1924, that Mr. Dunbar was to resign the agency in Cardiff, and on April 30th, when the respondents repudiated the agreement, what his Lordship described as a temporary and inadequate arrangement was still in force. Mr. Brown might have been quite sincere in his representations to the respondents that he was going to put the Cardiff agency on a proper footing, but his failure to do so for a period of four months was, his Lordship thought, a serious breach of contract.

Fraudulent Consumption of Electricity.

At Fleetwood, on March 13th, Lucy Ann Robinson, Fleetwood, was fined 40s. for fraudulently consuming electricity by using a standard lamp upon the heating circuit. The price for lighting was 6d. per kWh and for heating 1d. per kWh. It was stated that in 1927 the total amount of electricity used by Mrs. Robinson for lighting was 72 kWh and for heating 90 kWh, and in 1928 the figures were 36 and 142 kWh. respectively.

Mr. W. P. Lilwall, electrical engineer, said he told defendant that she could charge her wireless accumulator from the power circuit, but not use it for illuminating purposes.

An Unearthed Electric Drill.

At Wallasey on March 15th, the Gandy Belt Manufacturing Co., Ltd., Seacombe, was summoned for not having certain electrical apparatus properly earthed. It was stated that on January 11th an electric drill was connected to a 200-V a.c. circuit and used for drilling a steel girder. The drill was not earthed. Parts of the premises were in course of erection, and a man was working at a height using the drill for a few minutes. To save time the regulations were not carried out. Defendants were fined £5.

Ranton, Ltd., v. Wayne Electrical Co.

In the King's Bench Division on March 14th, Mr. Justice Branson had before him an action brought by Ranton, Ltd., London, against the Wayne Electrical Co., Nottingham, claiming £1,146 damages for breach of contact. Defendants denied liability. Plaintiffs' case was that in December, 1927, the defendants agreed to buy from them 5,000 "Bakelite" reels for attaching electric lamps to ceilings. Plaintiffs undertook to manufacture the reels at 5s. 9d. each according to sample. It was agreed that defendants should take delivery of the goods as required by them within 12 months from the date when plaintiffs were first able to supply them. Defendants, however, only took delivery of 48 of the reels in seven months, and plaintiffs took the view that this was a repudiation of the contract. Defendants now said that the goods supplied were not according to sample, and there had been no breach of the agreement as at the time of the issue of the writ they were willing to take delivery, and further there was no need for them to take delivery till the last day of the contract.

Mr. John B. Taunton, director and manager of the plaintiff company, said that his company spent a considerable sum of money in getting brass parts of the reel made which they themselves could not manufacture. At last they were in a position to deliver at least 500 weekly. Defendants, however, did not give orders for delivery, and plaintiffs took action, believing that defendants intended to repudiate the contract.

Counsel for defendants contended that the action was premature, and his Lordship held that this was so. The plaintiffs' case failed and was dismissed with costs.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Conditions in Baghdad.

As requested by "Baghdad" in your issue of March 1st, p. 408, I give below the approximate cost of living in Baghdad based on experience covering 10 years in Iraq:—

Monthly cost of living (food and general stores) not including drinks, Rs.200; servants, *i.e.*, cook and houseboy, Rs.100; conservancy, Rs.25; rent of European house, Rs.100 to Rs.150. Income-tax is payable on all incomes above Rs.400 per annum at 8 per cent., payable monthly if in Government service.

Ordinary European clothing can be worn for three months in the year; for four months the ordinary tropical outfit is needed; and for the remaining five months the lightest possible kit is worn with the thermometer in the region of 127 deg. F. in the shade. The climate is not really too bad, and the wet season extends from December to March. Usually cool winds blow at night during the hot season, which render the high day temperature bearable, and as much as 40 deg. F. difference is registered between maximum day and minimum night readings.

There are two good clubs in Baghdad and several good hotels where dancing and other functions take place nearly every night in the week. During the season good wild fowl and grouse shooting is available.

Iraqui.

March 11th, 1929.

Service Boxes.

Having read with interest the correspondence on the various types of service boxes in use on cable networks, may I, a skilled and so-called costly workman (to use, as near as possible, the words of a previous correspondent), an e.h.p. plumber-jointer, give expression to my views on the matter?

In the first case, the class of ground a network is installed in will, I contend, determine to a fair extent the type of box to use, and its price. To some engineers the latter overrules any other factor, meaning in quite a lot of cases a cheap job, both in material and workmanship, and consequent lost sleep and heavy repair costs. Unfortunately, this applies to a great amount of mains work. Dealing with c.i. boxes, of which many types are open to choice, and cheap: when installed in any ground, of an efficient make, provision being made for bonding armour, and roomy, the joint made with resin oil boiled tape, cooled off and properly topped up, made by a workman who understands and appreciates the necessity to install a decent job; this type of box has been found trouble-free in a large number of cases, though, as Mr. Payn says, the compound will not resist the penetration of moisture indefinitely. Therefore, this box is a potential source of trouble, and must give way to what I claim, and I believe will be agreed, a fool-proof job, and that is the stamped lead box. In my opinion, this box is the ideal towards a really efficient network. It necessarily follows there is no use in an engineer going to the expense of lead work, and having installations put in by inexperienced workmen. For were it not for the mechanical protection and the compound filling usually put in around the lead work, it would prove a bigger source of trouble than a c.i. box, due to would-be plumber-jointers and their so-called wiped joints, probably the kind of plumbed joint "Deuce" had in mind when he referred to a wiped joint not being watertight. I also agree with Mr. Payn regarding the filling of iron joint boxes and cooling off, a point neglected by most engineers, and not appreciated by others; the jointer should have sufficient experience to allow his work to cool down before capping up. Personally, I would install all cast lead boxes, stamped, or beaten up on site out of 10 lb. linear foot sheet lead, properly bonded (there are various methods of bonding) joint made with Indian cotton tape, boiled in resin oil, lead box with a resin oil filling, immersed in a creosoted wooden box filled with a low-grade compound. The cooling down of the resin would vary according to temperature, poured at, say, 170 deg. F. This would assure proper penetration over all parts of the joint. I have also made joint boxes from lead sleeving, which requires skill to make and install. I note

Mr. Payn's remarks of failure of jointers to answer advertisements, and their scarcity, which has previously been referred to by Mr. Robbins. It may interest Mr. Payn to learn that I have on occasions, along with others, advertised for employment with similar results to Mr. Payn—no answer. I have also written innumerable letters to supply authorities, but they had nothing to offer. This is due to Mr. Payn's idea having been given effect to, and a bunch of slap and dab hands engaged at a cheap rate to carry out the work; and the engineer wonders why he is always racing around with a test set. It is stated that good jointers are scarce: any wonder? A diligent man goes all out to get an all-round experience, travels thousands of miles, as I and as many others have done; when it comes to a supply job in particular, they want experienced hands, but are very adverse to offering a wage somewhat in keeping with the experience of the individuals concerned. Therefore, the all-rounder, capable of working without supervision, and carrying out a job from start to finish, or taking charge of work, finds himself with the same pay packet as the chancer who reaches the length of a service line, and I know cases where they are hardly fit for that, and would tremble to lose sight of the town clock. First-class hands can be obtained if the employer will offer the incentive. I would be interested to learn of a shop where the work of a good all-rounder would be appreciated. A trade test should be an item insisted upon by all engineers as a proof of competence, then less faulty work would be installed.

Cockenzie.

March 9th, 1929.

Engineers and the Future.

At a time when a future El Dorado is prophesied (and let us hope it does not turn out to be a mirage) it is rather interesting to note in a recent issue of the ELECTRICAL REVIEW that an "assistant instructor" is required by one of the leading correspondence colleges at a salary of £160-£180 per annum!! I think it would be rather difficult for the apostles of "Do you ring, or are you rung for?" to explain how they are going to turn out those £1,000-a-year men from the experience and knowledge of an engineer (must hold a degree) drawing £3 per week. All rather amusing, but hardly the material to convince people that these institutions do "deliver the goods."

Leslie R. Simmonds, Grad. I.E.E.

Nag Hammadi Barrage, Upper Egypt, *March 4th*, 1929.

Tramcar Regenerative Braking.

On June 15th, 1928, you published an article of mine on the subject of re-generated currents in tramway motors when braking. In the *Assa-Journal*, Volume 5, 1928, there is an article by a Mr. P. Friebel in which he refers to my article and suggests a very simple method of overcoming the difficulties which I bring to notice.

Mr. Friebel states that a very simple method of obtaining good braking is by connecting a small resistance in series with each armature. If this is to be introduced in existing equipment, it means that the resistance must be permanently in series, not only during braking, but during motoring also. Mr. Friebel suggests that a resistance of 1 ohm for each motor is a suitable value and that in some cases a much smaller value will suffice. Even if half an ohm were considered a suitable value, in my opinion it represents a most undesirable loss to be permanently in series with a large tramway motor, and I do not consider that it would be acceptable to the average British engineer.

Mr. Friebel states that the best means of overcoming the difficulty is by means of the well known cross-field connection. The advantages and disadvantages of this method are well known, but it is as well to point out that the chief objection is that any one lead breaking will prevent braking on both motors, and this point does not appear to be mentioned by Mr. Friebel.

E. H. Croft.

Birmingham, *March 13th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be numbered and abridged, and all subsequent proceedings will be taken.

1927.

22,648. "Electric transformers." British Thomson-Houston Co., Ltd., and C. G. Mayo. August 29th, 1927. (306,194.)
25,109. "Electric fuses." C. E. Bennett. September 23rd, 1926. (277,991.)
27,376. "Sound-reproducing apparatus for use with kinematograph films." A. Stevens. October 15th, 1927. (306,426.)
27,945. "Recording sound." S. K. Wilson and De Forest Phonofilms, Ltd. October 20th, 1927. (306,438.)
31,021. "Delay-action mechanism for electrical switches, gas cocks, or the like." W. W. Whiffin. November 18th, 1927. (306,574.)
31,064. "Low-pressure electric discharge apparatus." G. Valensi. November 18th, 1926. (280,948.)
31,132. "Electric vibratory relays." A. Reyrolle & Co., Ltd., and B. H. Leeson. November 19th, 1927. (306,470.)
31,162. "Circuit arrangements for thermionic devices." C. Flannagan. November 19th, 1927. (306,436.)
31,379. "Low-pressure electric discharge apparatus." G. Valensi. June 17th, 1927. (Addition to 280,948.) (292,455.)
31,390. "Constant-frequency control devices suitable for use in picture telegraphy." G. M. Wright. November 22nd, 1927. (306,580.)
31,392. "Apparatus for supplying power to the anodes of thermionic valves." H. A. Ewen. November 22nd, 1927. (306,500.)
31,441. "Apparatus for the application of the constant electrical current in medical practice." J. Shaw. November 23rd, 1927. (306 583.)
31,498. "Telephone systems." Siemens & Halske Akt. Ges November 24th, 1926. (281,297.)
31,548. "Telephone systems." Associated Telephone & Telegraph Co. March 23rd, 1927. (287,515.)
31,549. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. E. Beale. November 23rd, 1927. (306,592.)
31,959. "Manufacture of gasfilled electric incandescent lamps." General Electric Co., Ltd., F J. G. Van Den Bosch, and N. R. Campbell. November 28th, 1927. (306,612.)
32,476. "Constant-voltage dynamo-electric machinery." J. K. Im Thurn and T. H. Baines. December 1st, 1927. (306,626.)
32,773. "Terminal fitting for connector for spark-plugs." P. T. Webb. December 5th, 1927. (Convention date not granted.) (282,376.)
35,250. "Automatic circuit-breaker arrangements for the protection of electric generators." C. Meyer. May 4th, 1927. (289,846.)

1928.

158. "Electric bells." General Electric Co., Ltd., and J. R. Conchie. January 3rd, 1928. (306,661.)
215. "Electric transformers." W. C. Kennett and Hackbridge Electric Construction Co., Ltd. January 3rd, 1928. (306,662.)
294. "Selective switching devices for electric circuits." Tyer & Co., Ltd., and F. W. Leake. January 4th, 1928. (306,663.)
484. "Tramcars and similar vehicles." G. D. Peters & Co., Ltd., and H. R. Hockley. January 6th, 1928. (306,664.)
3,806. "Sending or controlling apparatus set by electrical impulses." Siemens Bros. & Co., Ltd., and D. A. Christian. February 7th, 1928. (306,683.)
4,321. "Acoustical devices such as loud speakers." E. D. Selway. February 11th, 1928. (306,692.)
5,758. "Electrical induction furnaces." N. R. Davis and Metropolitan-Vickers Electrical Co., Ltd. February 23rd, 1928. (306,707.)
7,425. "Electric motor control systems." G. H. Fletcher, R. Brooks, and Metropolitan-Vickers Electrical Co., Ltd. March 9th, 1928. (306,726.)
10,284. "Electrical gear for operating furnace and like doors." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. April 5th, 1928. (306,749.)
12,806. "Automatic and semi-automatic telephone systems." Telefonaktiebolaget L.M. Ericsson. May 2nd, 1927. (289,816.)
16,987. "Radio-transmitting systems" Westinghouse Electric & Manufacturing Co. June 18th, 1927. (292,469.)
20,745. "Electrodes for arc-welding and like purposes." Weldrics (1922), Ltd., and A. D. Anderson. July 17th, 1928. (306,785.)
21,453. "Filaments for electric incandescent optical-projection lamps." Falk, Stadelmann & Co., Ltd. November 23rd, 1927. (301,015.)
26,738. "Aerial systems." Marconi's Wireless Telegraph Co., Ltd. October 28th, 1927. (299,447.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 13th:—

Sopranist (lettering and design). No. 490,126 All goods in Class 8.—S. Kalisky (Aldgate), Ltd., 75, High Street, Aldgate, E.1.

Electronette. No. 491,858. All goods in Class 8.—The Parlophone Co., Ltd. 1, Broad Street Place, E.C.2.

Yep (lettering and design). No. 495,316. Class 8. Instruments and apparatus for use in wireless telegraphy and telephony.—George Constable, 49, Ballater Road, Acre Lane, Brixton, S.W.

Centrolian. No. 498,875. All goods in Class 8.—The Central Radio Co., Britannia Buildings, Fenwick Street, Liverpool.

Lister-Bruston. No. 491,091. Class 18. Electric lighting plants.—R. A. Lister & Co., Ltd., Victoria Ironworks, Dursley, Glos.

Toastmaster Automatic Electric Toaster (lettering and design). No. 497,956. Class 18. Electric toasting stoves.—Hector C. Adain, Ltd., 19-23, Oxford Street, W.1.

Limpet Tape. No. 496,270. Class 50. Electrical insulating tape composed of cotton impregnated with india-rubber.—Connollys (Blackley), Ltd., Blackley, Manchester.

Spray-Cooling of Water.

In a recent issue of *Chemical and Metallurgical Engineering* some interesting notes are given on the development of apparatus for the spray-cooling of water, by Mr. B. R. T. Collins. About 18 years ago the first low-pressure spray nozzle was developed. This nozzle operated at 7 lb. pressure at the nozzle, and confined the spray to a reasonable area, even in windy weather, so that the difficulty from drift with the high-pressure nozzles was avoided. During the past 15 years there have been between 6,000 and 8,000 installations of cooling ponds made in the United States and other countries. Some of the types of nozzle used have had small passages, which might become clogged with foreign matter if there should be any in the circulating water. Consequently, there is a tendency now toward nozzles which have no centre or openings smaller than the orifice, and rely upon impact of the water against itself to obtain the spraying effect.

A recent development of this type is the "ramp bottom" nozzle, which, as the name implies, has a bottom constructed on the principle of a spiral ramp, gradually ascending from the entrance until it has made one revolution. Here the water is caused to collide half way up on the entering stream, and this collision effect, with the large mixing chamber above, produces an absolutely uniform distribution of fine drops, leaving the orifice around its entire circumference.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Military barracks at Bridge of Don (£140,000); officer in command, Castlehill Barracks.

AMPTHILL.—Housing scheme (36), for the R.D.C.; L. Foster, surveyor, Flitwick, Bedford (returnable deposit of £1 1s.).

BARNSLEY.—Public abattoir (£33,250), for the T.C.; borough surveyor.

BECKENHAM.—Residential hotel, Elmers End Road (£17,000), for Copes Taverns, Ltd.

BLACKBURN.—Extension of Nurses' Home, Royal Infirmary (£19,980); Wm. Livesey & Sons, Ltd., builders. Addition to Albert Mill, Gate Street; manager. Addition to works, Ashton Street; manager.

BRADFORD.—Extensions at Technical College (£41,000); 100 tenements, Broomfields; city architect.

BRENTFORD.—108 flats for U.D.C.; E. Willis, architect.

BRISTOL.—Buildings for higher education and shop premises, corner of Unity Street and College Green; Education Committee and Society of Merchant Venturers. Boot factory, Forest Road, Kingswood, for Bawn Bros.

BROMLEY (Kent).—School, Bromley Common, for the Borough E.C.; director of education. Block of 24 shops, Widmore Road, for A. Frampton.

BUCKHURST HILL (Essex).—Extensions, Forest Hospital (£7,000); F. T. Cooper, hon. sec.

BURNLEY.—Fire station and firemen's dwellings, Belvedere Road and Leyland Road (£20,000); borough surveyor. Warehouse, &c., for the Brun Manufacturing Co., Ltd. (£10,000).

CAERPHILLY.—Church, for the Wesleyan trustees; secretary.

CARLISLE.—Additions, Cumberland Infirmary, Infirmary Street; John Burnett, Sons & Dick, architects.

CHESHIRE.—Isolation hospital; county medical officer.

COVENTRY.—Rebuilding scheme, Smithford Street, for Marks and Spencer, Ltd., bazaar proprietors, London.

CROSTON.—Public offices, for the U.D.C.; surveyor.

DARLINGTON.—Club and institute, Eldon Street; Cayley and Jarvis, architects. Houses (33); J. E. Chilton, architect, Houndgate.

DARTFORD.—Housing scheme (90), for the U.D.C.; surveyor (returnable deposit of £2 2s.).

DERBY.—Re-erection (after fire) of portion of Derwent Foundry, for the Qualcast Mowers Co., Ltd. (£30,000).

DORCHESTER.—Grammar school, for Dorset E.C.; director of education.

DORKING.—Telephone exchange, Abinger Hammer, for H.M. Office of Works, King Charles Street, S.W. (returnable deposit of £1 1s.).

DOVER.—Alterations, King's Hall, Biggin Street, for Theatre Securities, Ltd.; A. H. Steele.

DUKINFIELD.—Housing scheme (32) (deposit £2 2s.), Lord Street site; borough surveyor. Housing scheme (54) (deposit £2 2s.), Lodge Lane; borough surveyor.

DUNMOW.—Housing scheme (72), for the R.D.C.; J. Plumbley, surveyor, 58, New Street (returnable deposit of £1 1s.).

EDINBURGH.—Shops in Dundee Street for St. Cuthbert's Co-operative Association, Ltd.; the manager.

GILLINGHAM (Kent).—Houses (46), King Edward and Court Lodge Roads, for C. J. Howard.

GREEN STREET GREEN (Kent).—Cinema, for V. Gardner.

HADDINGTON.—Restoration and improvements at Holy Trinity Episcopal Church; the rector.

HALIFAX.—High school (£25,000), for the Borough E.C.; clerk.

HANLEY.—Additions, Victoria Works, Victoria Road; Swinnertons, Ltd.

HARROGATE.—Extension of Ashville College (£10,000); governors.

HASTINGS.—Reconstruction, White Rock Baths (£60,000), for the T.C.; borough engineer.

HENDON.—Public library (£35,000), for the U.D.C.; surveyor.

HUDDERSFIELD.—Additional 40 houses, Almondbury, for the T.C.; borough architect, 26, Ramsden Street. Extensions, Empress Works, for Brook Motors, Ltd., with electric light and heating work; J. Ainley, architect, 55, New Street (March 29th).

IPSWICH.—Houses (100), for the T.C.; Pearson & Blackwell, Ltd., Doncaster, builders.

IRISH FREE STATE (Clonmel, Co. Tipperary).—Completion of SS. Peter and Paul's Church (£17,000); Mr. Hearne, Waterford.

(Ennis, Co. Clare).—County sanatorium for the County Board of Health.

KEIGHLEY.—New buildings for Drake & Tonson's School (£19,950); governors.

KELSALL.—School (£15,422), for Cheshire E.C.; county architect, Newgate Street, Chester.

KING'S LYNN.—Extensions, Institution, with heating work, for the B.G.; E. E. Colman, architect (returnable deposit of £3 3s.).

LANARKSHIRE.—Cinema at Cambuslang (£22,000); W. B. Inglis, architect, Bath Street, Glasgow.

LINCOLN.—Additional 104 houses, for the T.C.; city surveyor.

LINTON (Cambs.).—Houses (76), for the R.D.C.; H. J. Painton, builder

LITTLE SHELFORD (Cambridge).—Re-erection (after fire) of the Hall, residence of Capt. Gordon Dill (£10,000).

LONDON (Lambeth, S.E.).—60 flats, China Walk; L.C.C. architect.

(Lewisham, S.E.).—60 flats, Winchfield Road; borough engineer.

(Bayswater, S.W.).—Extensions, Falmouth House, Clarendon Place, for Countess of Gosford; Wellesley & Wills.

(Streatham, S.W.).—Cinema, High Road, and Pendennis Road; Streatham Properties, Ltd. Dance hall and theatre, Streatham Hill; Pitcher Construction Co., Ltd.

(Wandsworth, S.W.).—Alterations and additions, factory of Sutherlands, Ltd., Riverside Road; W. G. Shearer. Additions, factory, Merton Road; Starkey & Gardner, Ltd.

LUDLOW.—Additional 40 houses for the T.C.; borough surveyor.

MAIDSTONE.—New buildings for Grammar School; Kent Education Committee.

MANSFIELD.—Additional 38 houses for the T.C., by direct labour; borough surveyor. Extensions, Brunts School (£12,000), for the Notts. E.C.; B. C. Westwick, architect.

MORDEN.—150 dwellings, St. Helier Estate; trustees, Douglas Haig Memorial Homes.

PAIGNTON.—24 bedrooms, ballroom, &c., Palace Hotel, Steartfield Road; Palace Hotel Co., Ltd. 42 houses, Lower Polsham Estate; C. Geen.

PAISLEY.—200 houses for Corporation; burgh surveyor.

PETERBOROUGH.—Houses (39) and shops, for the T.C.; W. H. A. Court, city engineer (returnable deposit of £1 1s. on each of two contracts).

PLYMOUTH.—Cinema, Union Street, for the Provincial Cinematograph Theatres, Ltd. Nurses' home, Mental Hospital (£19,580); borough architect.

PORTSMOUTH.—Secondary school for E.C. (£114,942); Rowland Bros., Horsham, contractors.

RICHMOND (Surrey).—New Cinema, Hill Street, with shops, flats, and houses (lighting and heating work), for Alderman J. T. Mears.

ROTHERHAM.—Joint hospital, St. Catherine's Estate; borough engineer. Extensions, Ivanhoe Works, Wortley Road; Robert Jenkins & Co., Ltd. Extensions, engineers' workshop, Thames Street; H. Duncan White.

ST. HELENS (Isle of Wight).—Housing scheme (30), for the U.D.C.; surveyor.

SALFORD.—Extension of Hope Infirmary; for Board of Guardians.

SANQUHAR.—Re-erection (after fire) of portion of Crawick Forge, for James Rigg & Sons, shovel manufacturers.

SHEFFIELD.—Mental institution, Hollow Meadows; Medical Officer of Health.

STEVENAGE.—Re-erection of The Croft, Walkern, residence of Mrs. Schlesinger.

STRETFORD.—Factory, Chester Road; W. S. Toms, Ltd.

UTTOXETER.—Additional 97 houses for the U.D.C.; surveyor.

WETHERBY.—Hotel (£30,000), for Wilfred Guy Johnson, Bradford.

WOODFORD (Essex).—Anti-aircraft headquarters, for the War Office; Pearson & Blackwell, Ltd., Doncaster, builders.

WORCESTER.—Re-erection of windscreen and electro-plating works, Sidbury, for F. A. Perkins, 9, Bewdley Hill, Kidderminster.